NAVAL SHIPS' TECHNICAL MANUAL

CHAPTER 631
VOLUME 3

PRESERVATION OF SHIPS IN SERVICE - SURFACE SHIP/ SUBMARINE APPLICATIONS

THIS CHAPTER SUPERSEDES S9086-VD-STM-030 OF 1 NOVEMBER 1992

PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND.

19 DEC 1996

NAVSEA TECHNICAL MANUAL CERTIFICATION SHEET 1 of 1

Certification Applies to: New Manual ☐ Revision ☒ Change ☐

Applicable TMINS/Pub. No. S9086–VD–STM–030/CH–631 Volume 3 Revision 1

Publication Date (Mo, Da, Yr) December 19, 1996

Title: NSTM Chapter 631, Volume 3, Preservation of Ships in Service-Surface Ship/Submarine Applications

TMCR/TMSR/Specification No:

CHANGES AND REVISIONS:

Purpose: Provide technical and policy changes and make administrative and typographical corrections.
Side bars in the outside margin indicate changes since the last revision.

Equipment Alteration Numbers Incorporated:

TMDER/ACN Numbers Incorporated: ACN 3/A, TMDER A46363 (ACNs 1/A and 2/A not issued.)

Continue on reverse side or add pages as needed.

CERTIFICATION STATEMENT

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Authority	Name	Signature	Organization	Code	Date
Acquisition	John Tock	John Tock	NAVSEA	O3M1	12/19/96
Technical	John Tock	John Tock	NAVSEA	O3M1	12/19/96
Printing Release					

Certification Sheet

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER 631

PRESERVATION OF SHIPS IN SERVICE
VOLUME 3.
SURFACE SHIP/SUBMARINE APPLICATIONS

SECTION 8.

SHIPBOARD PAINT APPLICATION

631-8.1 GENERAL

631-8.1.1 OVERVIEW. The application of paints to shipboard equipment, bilges, tanks, and interior and exterior surfaces of naval surface ships and submarines is covered in this section.

631-8.2 PRIMING AND INSULATING METAL SURFACES

631-8.2.1 PRIMING. Metal surfaces should be primed as soon as practical after surface preparation. This prevents corrosion and maintains the state of preservation until the finish coat can be applied. To prevent bimetallic corrosion, dissimilar metal surfaces shall be insulated from each other.

631-8.2.2 STEEL SURFACES. Except when otherwise specified, steel should be painted with at least one primer coat as soon as practical but in no case longer than 6 hours after surface preparation. See Section 5 for color coding requirements. See painting instructions pertaining to the end use of the steel to determine the proper primer for the coating system to be applied and the service requirements of the steel.

631-8.2.3 PRETREATMENT FORMULA 117. Formula 117, MIL-P-15328, is no longer approved for shipboard application. Formula 117 contains unacceptable levels of hazardous chromates and excessive volatile organic compounds (VOC) which make Formula 117 environmentally unacceptable. An acceptable substitute for non-immersion service is TT-P-645, Formula 84, Zinc Molybdate, Primer. An acceptable substitute for immersion service or intermittent splash zone service is MIL-P-24441, Formula 150, Paint, Epoxy Polyamide.

631-8.2.4 PRIMER COATS. Apply one priming coat to interior surfaces. Apply a complete second coat of primer to exterior surfaces. The first coat to all edges, welding, rivet heads, and other protruding objects shall be a brush applied stripe coat of primer. Clean and touch up areas that become bare or show rust.

631-8.2.5 GALVANIZED STEEL. Paint all galvanized steel unless painting is specifically excluded elsewhere in this chapter. Apply epoxy paints where coating is specified.

631-8.2.6 PAINT WELDS. Paint welds and damaged areas of galvanized surfaces as required for the surrounding galvanized area. Apply paint only to surfaces that have been cleaned (preferably by abrasive blasting). Where painting is not required, apply two coats of galvanizing repair paint (DOD-P-21035) to welds and damaged areas.

631-8.2.7 ALUMINUM SURFACES. Paint bare aluminum surfaces as soon as practical to prevent corrosion. The ship’s force should make frequent inspections of aluminum structure and fastenings to determine condition of the aluminum surfaces.

631-8.2.7.1 Aluminum Coating. Coating requirements for aluminum surfaces are specified in Table 631-8-1. Except for tanks, bilges, and voids, coat interior surfaces that are to be painted with two coats of Formula 84.

631-8.2.7.2 Faying Surfaces. Paint faying and other aluminum surfaces that are in contact with aluminum or joined to other metal or wood. Coat wood in contact with aluminum with one coat of spar varnish, FED Spec. TT-V-119.

631-8.2.7.2.1 Aluminum faying surfaces in contact with other metals that require sealing from moisture shall be treated as specified. All joints shall be sealed with caulking compound MIL-C-18255. For water-tightness, horizontal joints exposed to the weather shall be sealed with caulking compound. This is not required where butyl or neoprene rubber tape has been used.

631-8.2.7.2.2 Insulation tape shall be installed between faying surfaces where one or both sides of a joint are exposed to seawater, weather, or dampness. Tape should be at least 17 mils thick (two layers of MIL-I-24391 tape) and be of sufficient width to extend beyond the joint edge. Pressure-sensitive tape may be difficult to apply where insulating material will be inserted after final drilling and cleaning of faying surfaces. Wetting pressure-sensitive tape with kerosene or dusting lightly with talc before installing usually facilitates installation.

Table 631-8-1 COATING SYSTEMS FOR INTERIOR AND EXTERIOR ALUMINUM SURFACES

Exterior Topside System		**Interior[2] System**	
Coats	**Coating**	**Coats**	**Coating**
1	Epoxy primer (Formula 150)[1]		
1	Epoxy paint (Formula 151)	2	Anti-corrosive primer (Formula 84)
2	Silicone alkyd (haze gray MIL-P-24635)	2	Chlorinated alkyd, DOD-E-24607. Color to match surrounding area.

631-8.2.7.2.3 Install label plates in accordance with NAVSEA hull type drawing S2803-980208.

631-8.2.8 MISCELLANEOUS METALS. In interior compartments, corrosion-resistant steel, brass, nickel-copper alloy, and copper-nickel alloy are not required to be painted except to improve appearance. Where exterior areas are painted for camouflage, apply Formula 150 before application of finish paint.

631-8.2.8.1 Painting for Seawater and Fuel Oil. Painting for Seawater and Fuel Oil. In seawater tanks and fuel ballast tanks, completely paint corrosion resistant steel (CRES) and copper alloy piping to minimize the effect of galvanic corrosion on the coated tank surfaces. Copper-bearing piping and components shall be painted only after adequate masking of rubber items, gaskets, filters, heat exchange surfaces, and critical sealing surfaces.

631-8.2.9 DISSIMILAR METAL SURFACES. The most effective methods for preventing bimetallic corrosion are careful design to eliminate bimetallic interfaces and correct assembly. Excellent workmanship is required to insulate dissimilar metals effectively. Properly applied films of specified paints and insulation tapes may increase durability and prevent corrosion.

631-8.2.9.1 Dissimilar Metal Insulation. For insulation material to function effectively, it shall be installed so that all joints are closed; this ensures that water cannot collect and form a bridge between steel and aluminum and other bimetallic interfaces. For ships in service where no insulating tape appears to have been used, or where existing tape has deteriorated, horizontal joints exposed to the weather shall be sealed with caulking compound.

631-8.3 NON-METALLIC SURFACES

631-8.3.1 GENERAL. The painting and preservation of non-metallic surfaces such as wood, plastic, and rubber items are described in the following paragraphs.

631-8.3.2 WOOD SURFACES. Wood surfaces shall be preserved as specified in the following paragraphs and Section 9.

631-8.3.2.1 Varnished Surfaces. Fill defects in wood that is to be varnished with wood filler, FED Spec. TT-F-336. Stain the wood to the desired shade with one of the following stains: Formula 49, 50, 51, 52 or 54. Coat the stained wood with three coats of varnish, FED Spec. TT-V-119.

631-8.3.2.2 Painted Surfaces. In general, prime the wood with one coat of aluminum paint. Then apply finish paint (usually two coats). Prepare aluminum paint by mixing 2 pounds of aluminum paste, FED Spec. TT-P-320, Type II, Class 2, with 1 gallon of varnish, FED Spec. TT-V-119. Do not use aluminum paint on underwater surfaces or under vinyl anti-fouling (AF) paints.

631-8.3.2.3 Underwater Surfaces. For underwater surfaces, treat the wood with wood preservative, MIL-W-18142, then prime the wood with 2 coats Formula 150. Anti-fouling paint shall be applied as specified. Treat chain lockers and bilges with a heavy coat of wood preservative, MIL-W-18142.

631-8.3.3 FIBROUS GLASS BOARD. Coat fibrous glass board in interior compartments with chlorinated alkyd-base paint DOD-E-24607 or water-based paint conforming to DOD-C-24596 and Navy Formula 25A. Use one coat to finish, two if required for hiding.

631-8.3.4 RUBBER ITEMS. Rubber items (such as gaskets and expansion joint components) in contact with painted or cemented surfaces shall not be clamped in place under pressure until paints or cements have dried sufficiently. Allow painted surfaces to dry tack-free. Apply paint to rubber surfaces only when specified. Before putting rubber items in place, allow solvent to evaporate from applied cement until surfaces are only slightly tacky. Allow an additional 3-hour drying period before applying pressure.

631-8.3.5 PLASTIC. Plastic surfaces that are to be painted shall be pretreated with a coat of epoxy primer Formula 150. Plastic sonar domes, radomes, and special equipment shall be painted as specified in the applicable manual, drawing, or other document.

631-8.4 SHIPBOTTOM AND SUBMARINE TOPSIDE EPOXY ANTI-CORROSIVE COATINGS

631-8.4.1 GENERAL. Commercial epoxy anti-corrosive (AC) paints qualified as part of the coatings systems qualified to MIL-P-24647 are considered acceptable coatings for these applications. Coating shall be applied as recommended by the manufacturer except for minimum film thickness requirements. Film thickness requirements are to be as listed on qualified products list (QPL) 24647.

631-8.4.2 SURFACE PREPARATION. Minimum surface preparation standards for MIL-P-24441 coatings (Section 7) shall be followed if they are more stringent than the manufacturer's instructions. Naval Ships Systems Engineering Station (NAVSSES) shall be consulted for assistance in resolving any other conflicts.

631-8.4.3 FINAL COATS. Steel shipbottoms shall be coated in accordance with the coatings of Table 631-8-2. For aluminum hulls, see paragraph 631-8.6. For submarine topside use, the proprietary epoxy topcoats shall conform to the camouflage measures selected by the respective Fleet and Force Commanders and contained in S6360-AB-MMA-010,

Table 631-8-2 SHIPBOTTOM AND SUBMARINE TOPSIDE COMMERCIAL EPOXY AC/BARRIER COATING SYSTEMS

Source of Anti-Corrosive (AC) System	Coatings	Minimum DFT (mils)
MIL-P-24647	Refer to QPL-24647 for qualified coatings	Refer to QPL-24647 for qualified DFT

Submarine Camouflage Manual . Navy formula epoxy coatings MIL-P-24441 are compatible for use as either top coats over proprietary epoxy paints or for paint touch-up.

631-8.5 NAVSEA-APPROVED COATINGS FROM PROPRIETARY SOURCES

631-8.5.1 COMPETITIVE PURCHASES. Proprietary coatings are to be purchased on a competitive basis. Coating selection shall be made on the basis of factors which contribute to total application cost and time available for application. Paint thickness requirements specified in Table 631-8-2 shall be used for estimating total cost. The factors to be considered are:

a. Total coating material cost (that is, cost per square foot for required total dry film thickness, rather than cost per gallon).

b. Equipment available for coating application, and ease of application.

c. Ambient temperature, pot life, stand-in or induction time, drying time required between coats, and curing time.

d. Safety precautions required.

e. Colors of coating system as an aid to application and inspection of the surface during application and in service.

f. Availability of technical services.

631-8.5.2 COMPETITIVE PROCUREMENTS. Procurement activities should solicit invitations for bid and comply with Federal Acquisition Regulations (FAR) on each requisition for proprietary coatings.

631-8.6 ALUMINUM BOATS SHIPBOTTOM PAINT SYSTEM

631-8.6.1 APPLICATION OF AF PAINT. AF paint need not be applied to aluminum boats which are dry-berthed or subject to frequent beaching. The Type Commander has the responsibility for deciding whether to apply AF paint under these conditions.

631-8.6.2 RESPONSIBILITY FOR AF PAINT APPLICATION. Fleet Commanders and Force Commanders have the responsibility for specifying the desired AF paint colors for aluminum ships or crafts in their Commands, and for new aluminum ships or crafts scheduled to join their Commands.

631-8.6.3 USE OF ORGANOTIN AF PAINTS. Organotin AF paints and the proprietary products approved for use on underwater hull and aluminum boat boottopping are listed in Table 631-8-3. The safety precautions for organotin AF paints covered in Section 2 shall be observed. Intact paint shall not be removed. Organotin AF coatings are washed down to remove slime and surface contaminants, allowed to dry, and recoated with the identical AF system.

631-8.7 MIL-P-23236 BILGE AND TANK COATINGS. (Except Potable Water Tanks)

631-8.7.1 GENERAL. Paint coating systems that qualify under MIL-P-23236 and are listed in its Qualified Products List (QPL) are approved as coatings for tanks as specified.

631-8.7.2 MIL-P-23236 APPLICATION. Surface preparation by dry abrasive blasting to near-white metal is required for maximum adhesion and performance. Coating shall be applied as recommended by the manufacturer, except that minimum dry film thickness (DFT) requirements shall be as shown in QPL-23236.

Table 631-8-3 ALUMINUM BOATS SHIPBOTTOM COATING SYSTEMS

Paint System	Coatings[1]	Total Minimum DFT (mils)
International Paint Courtaulds	1 coat International FPL 274/FPA 327 Red 1 coat International FPY 034/FPA 327 Gray 1 coat International BXA/386, BXA/390, BXA/391 1 coat International BXA 816, BXA 821, BXA 822	4[1] 4 4 6

631-8.7.3 MIL-P-23236 COATING LIMITATIONS. QPL-23236 shall be consulted for a listing of the qualified products.

631-8.7.4 TOUCH-UP PAINTING. For touch-up painting, the same brand of coating (MIL-P-23236 or MIL-P-24441) shall be applied. Navy formula epoxy coatings in MIL-P-24441 are considered to be compatible topcoats for touch-up painting over the epoxy coatings in MIL-P-23236.

631-8.8 POTABLE WATER TANK (ALUMINUM AND STEEL SURFACE) COATING SYSTEMS

631-8.8.1 GENERAL. Excessively applied or inadequately cured potable (fresh) water tank coatings, have a potential impact on the crews well-being and morale because they make food and beverages unpalatable. Ship operating schedules have been adversely affected, in some cases requiring unanticipated additional time at an industrial activity for coating replacement.

631-8.8.2 POTABLE WATER TANKS. It is required that all potable water tanks be painted at each overhaul by a depot-level activity to maximize compliance with these procedures and to minimize the extent of potable water tank preservation required out of overhaul, when time allowed for paint curing may be marginal or inadequate.

631-8.8.3 APPROVED COATING SYSTEMS. Along with the Navy epoxy coating system, the commercial products listed in Table 631-8-4 are also approved for use in potable water tanks.

NOTE

The paints and coatings listed in this paragraph and their use criteria have been reviewed by NAVSEA and NEHC for compliance with Navy and NSF drinking water quality and safety requirements as well as for environmental, occupational safety and health compliance to the rules and regulations in effect on the date of the latest change notice. Fleet and shore activities procuring and using paints other than those listed herein have the responsibility of verifying that the paints comply with all such rules, regulations and laws.

631-8.8.4 PREFERRED SYSTEM. The MIL-P-24441 paint system provides the maximum preservation and blister resistance with the least solvent entrapment. MIL-P-24441, Type III Formulas 151, 152, 156, or 157 may be used interchangeably in potable water tanks. MIL-P-24441, Type IV paints are not approved for and shall not be used in potable water tanks nor shall MIL-P-24441, Type IV paints be used in feed water tanks.

631-8.8.5 TOUCH-UP PAINTING. Formula 102 shall be used only to touch up tanks already coated with Formula 102. Touch-up shall be as necessary to provide a total DFT of 4 mils minimum. For mixing of Formula 102, see MIL-E-15145. Application shall be brush or spray.

Table 631-8-4 POTABLE WATER TANK (ALUMINUM AND STEEL SURFACES)
COATING SYSTEMS

Paint System	Coatings	DFT (mils)
Standard Navy[1, 2, 3] MIL-P-24441)	1 coat Formula 150 (green) 2 or more coats Formula 151 (gray) 152 (white), 156 (red), or 157 (light gray)	2 to 4 2 to 4 per coat Total of 8 minimum
Seaguard Corporation	1 coat TANKGUARD No. 1 1 or more coats TANKGUARD No. 3	2 to 4 2 to 4 per coat Total of 8 minimum
International Paint[2] Company Tank Lining System	1 coat INTERGARD 5805/5804 (green) 1 or more coats INTERGARD 5827/5806 (white)	2 to 4 per coat 2 to 4 per coat Total of 8 minimum
Devoe Marine Division	1 coat DEVRAN 207 (pale gray) 1 coat DEVRAN 207 (pale yellow) 1 or more coats DEVRAN 207 (pale blue)	1 to 2 per coat 1 to 2 per coat 1 to 2 per coat Total of 6 minimum
The Valspar Corporation	1 coat Valspar 264-W-12 1 coat Valspar 264-F-25	4 per coat 4 per coat

631-8.8.6 PROPRIETARY COATINGS. Proprietary coatings listed in Table 631-8-4 shall be mixed and applied according to the manufacturer's instructions and as specified in this chapter. If ambiguity exists, requirements of this chapter shall govern. Any unresolved conflicts shall be reported to NAVSSES for guidance.

631-8.8.7 COATING REQUIREMENTS. The following requirements apply to all coatings used in potable water tanks:

a. Drying time between coats shall be no less than 48 hours at a minimum temperature of 21°C (70°F). Heated air shall be used if necessary to maintain the proper temperature.

b. Ventilation shall be a continuous airflow with a minimum of one complete air change every 4 hours.

c. Fully coated tanks shall be cured for a minimum of 7 days under the same conditions before being filled.

d. Refer to Section 2 for ventilation requirements guidance.

e. Freshly painted potable water tanks shall be rinsed at least twice with fresh water before being disinfected and put into service. See NAVMED P-5010, Manual of Naval Preventive Medicine, Chapter 6, Water Supply Afloat for direction.

f. During painting of tanks, after application of the primer or first coat of the system, the contractor shall precoat (stripe) all flanges, edges, and weld seams by brush (roller, dauber) with the next coating to be applied between each coat of the specified system.

631-8.8.7.1 Accelerated Touch-Up. It is recognized that situations arise where very limited touch-up is required, and specified drying times have an adverse impact on ship schedule. The following accelerated drying requirements for touch-up coating is allowed (non-reactor potable water tanks):

a. Two days wait between coats and two days after final coat if the largest single touch-up area is less than one square foot and the total touch-up area is less than four square feet.

b. Two days wait between coats and three days after the final coat if the largest single area is between one and two square feet or the total touch-up area is less than ten square feet.

c. Wait the full seven days if any single area is over two square feet.

631-8.8.7.2 Approval Authority. Any deviation to the above accelerated paint drying or curing requirements should be referred to NAVSSES or NAVSEA for approval (specific Reactor Plant Planning Yard approval is required for reactor plant tanks), including proposed resolution such as using heat to shorten drying and curing times.

631-8.8.8 FILM THICKNESS REQUIREMENTS. Wet Film Thickness (WFT) to DFT ratios should be locally determined for the selected coating. Use the same mixing and application procedures which will be used for ship tank painting. Painters should be instructed to apply paint within a WFT range that will result in the required DFT. All potable water tank painters should be supplied with WFT gauges and instructed on their proper use.

631-8.8.8.1 Ensuring Proper Film Thickness. Procedure shall be instituted to ensure that maximum per-coat film thickness is not exceeded. Total film thickness of each approved system shall not exceed the maximum per-coat thickness, multiplied by the number of coats applied, for at least 98 percent of the tank surface area.

631-8.8.8.2 Excessive Thickness Areas. Adequate painting for preservation may result in excessive thickness near angular shapes. In isolated areas, near stiffeners for example, the maximum DFT may be exceeded by up to 2 mils per coat, providing the total noncomplying area is less than 2 percent of the tank surface. For touch-up or overcoating intact aged paint in good condition, the same requirements apply. The total film thickness require-

ment may be corrected to allow for the thickness of underlying paint. The requirement is to avoid excess thickness in individual coats. High DFT resulting from properly applied extra coats is not considered to be a problem below 15 mils total.

631-8.8.9 POTABLE WATER CONTAMINATION. For any suspected case of potable water contamination, the Navy Environmental Preventive Medicine Unit (NAVENPVNTMEDU) should be requested to determine the degree of personnel hazard. They should also be requested to recommend proper water treatment procedures, including sampling procedures. For assistance with corrective action and to enact preventive measures for other ships, NAVSSES should be advised of all cases where paint is the suspected cause of contamination.

631-8.8.10 QUALITY ASSURANCE. Minimum quality assurance inspections for potable water tank coatings shall include:

a. Surface preparation (to ensure freedom from surface dirt, moisture, or other contaminants).

b. DFT of any remaining aged coating.

c. DFT after application of each coat, recording at least five measurements per 1,000 square feet of surface.

d. Hardness of paint (to ensure that each coat has cured thoroughly).

631-8.9 FEEDWATER TANK COATING SYSTEMS

631-8.9.1 APPROVED FEEDWATER TANK COATINGS. Navy and proprietary coatings approved for use in feedwater tanks (except for those used in nuclear-propelled ships) are listed in Table 631-8-5. The coatings authorized for potable water tanks are also approved as alternatives to those specified in Table 631-8-5.

631-8.9.2 POTABLE WATER TANK PROCEDURES. The paint mixing and tank ventilation requirements for potable water tanks shall apply for feedwater tank coating systems.

631-8.10 MACHINERY AND PIPING.

Equipment on surface ships and submarines is usually supplied painted and preserved as required by either the individual purchase specifications or the operating manual. If the equipment is received in an unpainted condition or if the coating is damaged before or during installation, painting and preservation shall be done as specified in Table 631-8-6.

631-8.10.1 COLOR CODING PIPING AND VALVES. Piping and valves shall be painted the color specified in **NSTM Chapter 505, Piping Systems** . Where no color is specified, use the same color as the surrounding structure. NSTM Chapter 505 shall be used for exterior valve identification markings.

Table 631-8-5 FEEDWATER TANK COATING SYSTEMS

Paint Systems	Coatings[1,2]	DFT (mils)
MIL-P-24441[3]	1 coat Formula 150 (green) 1 coat Formula 151 (gray) 1 coat Formula 152 (white)	1-4 1-4 8 minimum total
Devoe Marine[3] Division	1 coat DEVRAN 244HS (blue) 1 coat DEVRAN 244HS (white)	4 minimum 4 minimum

Table 631-8-5 FEEDWATER TANK COATING SYSTEMS - Continued

Paint Systems	Coatings[1,2]	DFT (mils)
International[3] Paint Co.	1 coat INTERGARD FPJ 034/FPA (gray) 1 coat INTERGARD FPD 052/FPA (white)	4 minimum 4 minimum
The Valspar Corporation	1 coat SOVAPON 264-F-25 (gray) 1 coat SOVAPON 264-W-12 (white)	4 minimum 4 minimum

631-8.10.2 ALTERNATE COLORS. As an alternate to machinery gray (Formula 111), the use of the paints listed in Table 631-8-7 is approved for machine shops and engine rooms on surface ships when directed by the Type Commander. See paragraph 631-8.23.3 for alternative paints for submarine engine rooms.

631-8.10.3 INSPECTION OF SSBN AIR-EJECT PIPING. See paragraph 631-8.25.10 for inspection and preservation of SSBN missile launch air-eject piping.

631-8.11 ELECTRIC AND ELECTRONIC EQUIPMENT.

Electric and electronic equipment will usually be supplied painted and preserved as required by either the individual purchase specifications or the operating manual. Painting and preservation may be necessary if the equipment is received in an unpainted condition or if the coating has been damaged before or during installation. In addition, painting and preservation are necessary for finishing after installation.

Table 631-8-6 MACHINERY AND PIPING COATINGS

Surface	Paint System (number of coats and formula no.)	Minimum DFT (mils)	Notes
Ferrous machinery surfaces (unheated, external, and internal)	1. 1 coat of 84 1 coat of 11 2. 1 coat of 84 2 finish coats to match the surrounding area	1.5 1.5 1.5 3.0	8 8
Ferrous sheet metal surfaces (unheated, external, and internal)	1 coat of 84 2 coats of finish coat to match surrounding compartment or area	1.5 3.0	1,8
Ferrous sheet metal surfaces (heated, external, and internal)	2 coats of TT-P-28	1.0	2,4
Ferrous machinery surfaces (heated, external, and internal)	2 coats of TT-P-28	1.0	3,4
Machinery gauge boards (including gauges and clocks)	1 coat of 84 2 coats of 111	1.5 3.0	8
Thermally insulated machinery, valves and piping	2 coats of TT-P-28 under insulation 1 finish coat over thermal insulation	1.0 1.0	2,4,10
Gasoline piping and valves	1 coat of 84 1 coat of TT-E-489	1.5 1.5	1,8
Oxygen piping and valves	1 coat of 84 1 coat of TT-E-489	1.5 1.5	1,8

Table 631-8-6 MACHINERY AND PIPING COATINGS - Continued

Surface	Paint System (number of coats and formula no.)	Minimum DFT (mils)	Notes
Boilers and economizers (except parts used for heat transfer)	2 coats of TT-P-28	1.0	4
JP-5 piping and valves	1 coat of 84 2 coats of finish coat	1.5 3.0	1,8
Shore steam connections and valves	DOD-STD-2138	- - -	11
Piping, fittings, and valves (galvanized and ungalvanized steel), and aluminum	1 coat of 84 2 coats of finish coat	1.5 3.0	1,5, 6,8, 10
Nonferrous and corrosion-resistant steel piping and valves, non-immersion areas	Unpainted	- - -	- - -
Nonferrous and corrosion-resistant steel piping and valves, immersion areas	Paint together with surrounding immersion areas	Various	9

631-8.11.1 PAINTING ELECTRIC AND ELECTRONIC EQUIPMENT. Except as otherwise specified, the painting and preservation of electric and electronic equipment will comprise:

a. One coat of primer (Formula 84).

b. Two coats of gray enamel (Formula 111).

Table 631-8-7 SURFACE SHIP MACHINE SHOP AND ENGINE ROOM PAINTS

Coating	FED-STD-595 Color No.	Coating	Uses
Brilliant yellow	13538	TT-E-489	Crane hooks and pulleys
Vivid orange	12246	TT-E-489	Exposed hazards
Clear blue	15177	TT-E-489	Switch box control panels
Highlight buff	13578	TT-E-489	Highlight areas to concentrate attention
Machinery gray	To match Formula 111	Formula 111	Body of machinery

631-8.12 MOTORS AND GENERATORS.

631-8.12.1 PAINTING MOTORS AND GENERATORS. Motors and generators shall be painted according to the following paragraphs.

631-8.12.2 EXTERIOR PARTS. Except for shafts and identification plates, paint exterior parts in accordance with paragraph 631-8.11.1.

631-8.12.3 INTERIOR PARTS. Electrical insulation of all types and surfaces in contact with lubricating oil or grease, commutators, collector rings, brushes, bearings, and bearing surfaces shall not be painted. Do not paint peripheries of armatures and rotors or any other rotating part of a machine from which centrifugal force may cause the paint to be thrown on to the windings when the machine is operated at rated load and rated ambient temperature. Insulation varnish conforming to MIL-I-24092, instead of paint, may be applied to such parts. Paint other corrosion-resistant parts in accordance with paragraph 631-8.11.1.

631-8.12.3.1 Inside Ends of Motors and Generators. Apply one coat of primer (Formula 150) or primer (Formula 84) followed by one coat of white enamel (FED Spec. TT-E-489) to the inside of both ends of the enclosure of water-or air-cooled motors and generators.

631-8.12.3.2 Reduce Wear of Motor and Generator Brushes. To reduce wear of carbon brushes, paints which contain silicon resins, such as FED Spec. TT-P-28 shall not be used on, or in close proximity to, motors and generators. Consult NAVSSES for guidance to resolve any conflicts. As specified in paragraph 631-8.25.6, motor generators on submarines also require protection from MIL-P-24441, MIL-P-23236, and NAVSEA-approved fresh-water tank coatings.

631-8.13 SWITCHBOARDS AND PANELS.

631-8.13.1 Switchboards and dead-front type panels for control, power, lighting applications, and for electric propulsion shall be given an additional finish coat only if cleaning and touch-up will not give the desired result.

631-8.14 ELECTRIC CABLES.

631-8.14.1 Damaged areas of previously painted armored cables shall be touched up with one coat of primer, Formula 84 or Formula 150. Supporting structure for cable shall be primed before installation of cable. After being secured in position, primed armored cable and supporting structure and unpainted unarmored cable shall be finish coated to match surrounding structure with Ocean Chemical Co. 634/9788, fire retardant, water base DOD-C-24596, Type I or Navy Formula 25A as required during overhaul. For surface ships, a fire protective coating shall be applied to fire zone penetrations (collars, multiple cable penetrators and stuffing tubes) as a fire stop method where PVC jacketed cable is installed. Consult NAVSEA for approved sources and application procedures. If bare, unarmored cables are to be painted, the first coat shall be a water base paint qualified to DOD-C-24596, OCEAN 634, or Navy Formula 25A. Finish painting to match the surrounding area may be with the above water base paints or with DOD-E-24607 solvent base, fire retardant, chlorinated alkyd enamel.

631-8.15 METAL ENCLOSURES.

631-8.15.1 GENERAL. Enclosures for motor controllers, electric panels, wiring boxes, fittings, fixtures (including those complying with NAVSEA standard plans), and enclosures for electric equipment in general (except electronic interior communication, and fire control equipment) for which painting is not otherwise specified in purchase specifications, shall be coated as specified in Table 631-8-8. For equipment received with pretreatment and primer only, apply finish coats as appropriate. Finish-paint matching the surrounding structure may be applied over formula 111 to avoid masking enclosures when painting surrounding structure. Touch up any damaged coatings as required. Formula 117 pretreatment is not to be used.

631-8.15.2 PAINTING BRASS, CRES, AND NONFERROUS METALS. Brass, CRES, and nonferrous metals other than aluminum shall not be coated except where painting is desirable for appearance or camouflage.

631-8.16 INTERIOR COMMUNICATION AND FIRE CONTROL EQUIPMENT.

631-8.16.1 Manufacturers usually supply Interior Communication (IC) and Fire Control (FC) switchboards, amplifiers, panels, and equipment components finished according to MIL-E-983, MIL-E-16400, or MIL-F-18870; no additional painting is required in these cases. Touch-up painting, as required, shall be in accordance with Table 631-8-8.

Table 631-8-8 METAL ENCLOSURE COATINGS

Coat	Galvanized Steel[1]	Bare Steel[1]	Aluminum[1]	Miscellaneous Metals[2]
Pretreatment	None	Phosphate coating TT-C-490, Type I	None	None
Primer	One coat of Formula 150	One coat of Formula 84	One coat of Formula 84	One coat of Formula 84
Finish coats[3,4]	Two coats of Formula 111, or two coats of finish paint to match surrounding structure.			

631-8.17 LIGHTING SYSTEMS.

631-8.17.1 Do not paint light-reflecting and light-transmitting surfaces of lighting fixtures and gaskets, rubber packing, or watertight work.

631-8.18 RADAR AND ACOUSTICAL EQUIPMENT AND SONAR DOMES.

631-8.18.1 During installation, take precautions to preserve the original finish of submarine electronics equipment and sonar domes. Touch up damaged areas as required.

631-8.19 ELECTRONIC EQUIPMENT.

631-8.19.1 GENERAL. Restoration of radar antennas AS-1092/SPS-43A and AS-932/SPS-17A is described in NAVSEA 0967-LP-221-1010, Radar Antenna. Restoration of antennas AS-943/SPS-29 and AS-1091/SPS-43 is described in NAVSEA 0967-LP-052-8280, TTR Radar Set. For antenna (receiver and transmitters), radomes and covers that are not addressed herein, use materials per MIL-P-24441/2, Formula 151 applied in accordance with MIL-E-16400 at a facility that is capable of applying epoxy polyamide coatings in a controlled environment.

631-8.19.2 ALUMINUM ALLOY TRANSMITTING AND RECEIVING ANTENNA. Give aluminum alloy transmitting and receiving antenna whips and ferrous antenna whips two coats of Formula 150. Follow these with one coat of MIL-E-24635 (haze gray) paint on stack-mounted whip antennas before installation unless special finishes have been applied in accordance with purchase specifications.

631-8.19.3 WAVEGUIDES. Waveguides shall be protected and preserved on interior and exterior surfaces according to installation standards of NAVSEA 0967-LP-000-0110, Electronic Installation Maintenance Book, before and after installation.

631-8.19.4 SHOCK MOUNTS. Care shall be taken to avoid painting electrical contact points, ceramic insulators, rubber insulation mounts (shock or noise mounts), and insulation materials of all kinds. Mask all such parts before painting. Finish-paint submarine antennas, except for insulators, as required for camouflage.

631-8.19.5 FIBERGLASS FAIRINGS. The painting and camouflaging of submarine fiberglass faired masts and radomes shall be done in accordance with NAVSEA SE110-DK-MMO-010, Procedures for Inspection, Repair, and Painting of Fiberglass Mast Assemblies. Paint specifications for antenna domes on SSBN-616, SSBN-627, and SSBN-640 Class submarines are given in NAVSEA 0967-LP-559-7011, Installation and Dome Grooming Procedures for the ILS Acoustic Group.

631-8.19.6 RADOMES. Coat specialized radomes and other similar housings in accordance with the instruction book provided. No other coating shall be applied.

631-8.20 SONAR DOMES.

631-8.20.1 AN/BQR-21 painting is specified in NAVSEA 0967-LP-559-7020, Installation and Dome Grooming Procedures for SSBN-598 Class submarines.

631-8.20.2 Acoustical surfaces of sonar components (exterior to the hull of the ship) not supplied finished by the manufacturer shall be painted in accordance with the instructions in the appropriate volumes of the Sonar Dome Handbook as listed below:

a. NAVSEA 0967-LP-412-3010, Volume I, AN/SPS-4 Series and AN/SQS-23 Sonar Domes.

b. NAVSEA 0967-LP-412-3020, Volume II, AN/SQS-26 Steel and Rubber Sonar Domes.

c. NAVSEA 0967-LP-412-3030, Volume III, AN/SQS-38 GRP Sonar Domes.

d. NAVSEA 0967-LP-412-3040, Volume IV, AN/SQQ-23 Rubber Sonar Domes.

e. NAVSEA S9065-AC-HBK-010, Submarine Sonar Domes.

631-8.21 MISCELLANEOUS EQUIPMENT.

631-8.21.1 Painting specifications for miscellaneous shipboard equipment are given in Table 631-8-9.

Table 631-8-9 MISCELLANEOUS EQUIPMENT COATINGS

Item	Paint System (Number of Coats and Formula No.)	Minimum DFT (mils)	Notes
Anchor (surface ship bow anchors) (For anchors below lower boottopping limit, see note 21)	2 coats of 150 2 coats of MIL-E-24635, color number 26270 of FED-STD-595	6.0 1.5 per coat	21
Anchor chain	- - -	10.0	21
Anchor, Keel	- - -	- - -	21
Antenna insulator fittings	1. 2 coats of 150 2. 2 coats of 84	5.0 3.0	1 1

Table 631-8-9 MISCELLANEOUS EQUIPMENT COATINGS - Continued

Item	Paint System (Number of Coats and Formula No.)	Minimum DFT (mils)	Notes
Bilge keels, shaft, struts and skegs (internal surfaces)	1 coat of MIL-C-16173, Grade 1, rust preventive	- - -	2
Catapult launching valves and exhaust	1. DOD-STD-2138 2. 2 or 3 coats of MIL-P-23236, Class 1 epoxy 3. 3 coats of MIL-P-24441	- - - 8.0 8.0	17 15 15
Exterior canvas lagging and life floats (rafts)	Gray canvas preservative FED Spec. TT-P-595	- - -	3
Fireplugs and foam discharge valves	1 coat MIL-PRF-24635, Color Number 11105 (Red)	3.0	4,19
Furniture and joiner doors	As specified in MIL-F-902	- - -	5
Helmets	1 coats of 84 1 coat of MIL-E-24635	1.5 3.0	
Inaccessible surfaces (galvanized and nonferrous)	Unpainted	- - -	6
Inaccessible surfaces (ungalvanized steel)	1. 1 coats of NAVSEA approved inorganic zinc 2. 2 coats of 150 3. 2 coats of 84 4. MIL-C-11796 Class 1 or 1A	3.0 6.0 3.0 3.0	7,16 8 8
Messenger buoys	1 coat MIL-PRF-24635, Color Number 12197	6.0	
Propellers (composition or corrosion-resistant)	Clean and polish bright	- - -	
Ring buoys	3 coats of orange plastic	- - -	9
Rudders and skegs (internal surfaces)	MIL-C-16173 Grade 1 or 3 rust preventive	- - -	2
Shafting, inboard	2 coats of 150 1 coat of 151	6.0 3.0	
Shafting, outboard	MIL-R-15058 or resin-glass cloth coating, followed by AF coating system specified in Table 631-8-2	- - -	10, 14
Shaft tube (internal)	1 coat of 150 1 coat of 151 1 coat of 152	3.0 3.0 3.0	
Smoke pipes	2 coats of FED Spec. TT-P-28	1.0	11
Structure behind insulation	1 coat of 150 1 coat of 151	3.0 3.0	
Ventilation ducts and trunks (ungalvanized steel)	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. 1 coat of NAVSEA approved inorganic zinc. 1 coat of 150 (mist coat) 1 coat of 151 1 coat of 151 or 153 3. DOD-STD-2138	3.0 3.0 3.0 3.0 0.5-1.0 3.0 3.0 - - -	12

Table 631-8-9 MISCELLANEOUS EQUIPMENT COATINGS - Continued

Item	Paint System (Number of Coats and Formula No.)	Minimum DFT (mils)	Notes
Seamless coating for small objects	Plastisols	- - -	18
Surfaces subject to exposure to MIL-H-19457 hydraulic fluid	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. 2 or 3 coats of MIL-P-23236, Class 1 (epoxy)	3.0 3.0 3.0 8.0	15 15
Turntable pits (LST's)	2 or 3 coats of MIL-P-23236, Class 1 (epoxy)	8.0	15

631-8.22 SHIPBOARD ITEMS NOT TO BE PAINTED

631-8.22.1 ITEMS NOT TO PAINT The following Navy shipboard items are not to be painted:

a. CRES decks, CRES galley equipment, and CRES bulkheads in wet spaces. CRES and nonferrous piping in dry bilges.

b. Decorative plastic surfaces such as those on bulkheads and table tops.

c. Dogs (or operating gear) on watertight doors, hatches, scuttles, and similar items.

d. Hatch and door rubber gaskets, rubber window moldings.

e. Sight glasses, gauge faces, and identification plates and other markings which, if painted, would be illegible.

f. Insulators.

g. Knife edges of watertight doors and hatches.

h. Porcelainized surfaces.

i. Threaded parts, such as adjusting threads and take-up threads which, if painted, would not function properly.

NOTE

Paint applied to these fasteners need not be removed unless excess paint interferes with threaded fastener adjustments. Previously painted adjustable threaded fasteners shall not be repainted.

j. Anodes and cathodic protectors.

k. The following interior aluminum surfaces:

1 Bins, shelves, dressers, cabinets, battens, and fittings.

2 Interior gratings, handrails, and floor plates.

3 Internal ventilation duct surfaces.

l. Electrical outlets, terminals, activating mechanisms of electrical safety devices, and control switchboards on machinery elevators.

m. Bell pulls, sheaves, annunciator chains, and other mechanical communication devices.

n. Composition metal water ends of pumps.

o. Condenser heads and outside surfaces of condensers when made of composition metal.

p. Within magazines, dry sprinkling piping with holes drilled in the pipe top.

q. Exposed composition metal part of any machinery.

r. Valve stems, packing glands, gland threaded fasteners, and internal surfaces.

NOTE

Paint which was applied to packing glands and gland threaded fasteners need not be removed unless there is excess paint which interferes with valve packing adjustment. Previously painted packing glands and gland threaded fasteners shall not be repainted.

s. Heat exchange surfaces of heating or cooling equipment.

t. Joint faces of gaskets and packing surfaces.

u. Lubricating gear, such as oil holes, oil or grease fittings and oil or grease cups, and lubricators and surfaces in contact with lubricating oil.

v. Lubricating oil reservoirs.

w. Machined metal surfaces of reciprocating engines or pumps and all oil-wetted surfaces of internal combustion engines.

x. Metal lagging.

y. Rods, gears, universal joints, and couplings of valve operating gear.

z. Expansion joints, nonferrous parts of pipe hangers, flexible hose connections, items partially fabricated of rubber, and resilient elements of isolation mounts.

aa. Sliding feet of turbines and boilers.

ab. Springs.

ac. Strainers

ad. Turbine casing joints, nuts, and bolts.

ae. Working surfaces.

af. Deck fittings and joiner hardware on plastic boats.

ag. Light-reflecting and light-transmitting surfaces of items such as light fixtures, ports, and windows.

ah. Faces of sonar transducers, hydrophones, NOFOUL rubber sheeting, sonar dome rubber windows, rubber sonar domes, and AN/SQS-38 glass-reinforced plastic domes, except when otherwise specified in documents such as equipment manuals.

ai. Rubber surfaces, except when specified.

aj. Grounding contact surface.

ak. Label plates.

631-8.22.2 SPECIAL ITEMS NOT TO BE PAINTED. Corrosion resistant reactor plant and propulsion plant systems in nuclear-powered ships are not to be painted, except as identified in the surface ship and submarine general reactor plant overhaul and repair specifications (NAVSEA 0989-LP-043-0000 and 0989-LP-037-2000, respectively).

631-8.23 SURFACE SHIPS

631-8.23.1 GENERAL. The preservation and coating of the interior and exterior surfaces of naval surface ships are described in the following paragraphs.

631-8.23.2 EXTERIOR SURFACES. Metal exterior surfaces of all surface ships and crafts shall be coated in accordance with the requirements in Table 631-8-10 and Table 631-8-11. All wood exterior surfaces shall be coated in accordance with the requirements in Table 631-8-12.

Table 631-8-10 PAINT SYSTEMS FOR EXTERIOR STEEL SURFACES ON SURFACE SHIPS

Location	Paint System (Number of Coats and Formula No.)	Minimum DFT (mils)	Notes
Exterior horizontal	1 coat of 150 1 coat of 151 or 150 1 coat MIL-PRF-24635 haze gray (color no. 26270) 1 coat of inorganic zinc 1 coat of 150 (mist coat) 1 coat of 151 or 150 1 coat MIL-PRF-24635 haze gray (color no. 26270)	3 3 3 3 0.5 to 1 3 3	2,4,5,9,10 2,3,4,5,9,10. See Section 7
Rudders and struts	- - -	- - -	11
Fittings and exterior piping	1 coat of inorganic zinc 1 coat of 150 (mist) 1 coat of 151 1 coat MIL-PRF-24635 gray (color no. 26270) 1 coat of 150 1 coat of 151 or 150 1 coat MIL-PRF-24635 haze (color no. 26270)	3 1 3 3 3 3 3	2,3,4,7,8,9,10 2,4,7,8,9,10
All exterior vertical and near vertical surfaces from the upper boottopping limit	1 coat of 150 1 coat of 151 or 150 1 coat MIL-PRF-24635 haze gray (color no. 26270) 1 coat of inorganic zinc 1 coat of 150 (mist coat) 1 coat of 151 or 150 1 coat MIL-PRF-24635 haze gray (color no. 26270)	3 3 3 3 0.5 to 1 3 3	2,4,7,8,9,10.13,14 2,3,4,7,8,9,10. See Section 7 13, 14
Keel to the upper boottopping limit.	- - -	- - -	1,12

Table 631-8-11 ANTI-FOULING PAINT SYSTEMS FOR STEEL SHIPS

Location	Paint System	Minimum DFT (Mils)
Keel to Upper Boottop Limit	Underwater hull coating systems shall be five, seven, or ten year systems qualified to military specification, MIL-PRF-24647, and listed on the Qualified Products List (QPL) - QPL-24647.	Note 1
	Anti-corrosive and anti-fouling paint shall be applied in alternating colors to ensure coverage and to aid in failure analysis. Anti-fouling paint shall be applied in the order Red/Black/Red except in the boottop area where all three coats shall be Black.	
	If a two year anti-fouling paint is desired, the anti-fouling paint shall conform to the requirements of military specification, MIL-P-15931. The underwater hull anti-corrosive coating shall conform to military specification, MIL-P-24441 and be listed on the latest QPL-24441. The MIL-P-24441 system shall be three coats and consist of formula 150 (green primer), formula 151 (haze gray) and formula 154 (dark gray). Alternatively, an anti-corrosive coating qualified to MIL-PRF-24647 may be used.	

NOTES:

1. Minimum DFT shall be as listed on QPL-24647.
2. Applications of MIL-PRF-24547, Type I ablative anticorrosive (AC) and antifouling (AF) ship hull paint systems on the underwater hull shall be as follows:
   For 5 years of service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils dry film thickness (DFT) each, for a total of 10 mils AC DFT.
   Apply 2 coats ablative AF of alternating color @ 5 mils DFT each, for a total of 10 mils AF DFT.
   For 7 years of service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils DFT each, for a total of 10 mils AC DFT.
   Apply 2 coats ablative AF of alternating color @ 6 mils DFT each, for a total of 12 mils AF DFT.
   For 10 years service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils DFT each, for a total of 10 mils AC DFT.
   Apply 3 coats ablative AF of alternating color @ 5 mils DFT each, for a total of 15 mils AF DFT.
   Applications of MIL-PRF-24847, Type I ablative AC and AF ship hull paint systems for the boottop area shall be as follows:
   For 5 years service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils DFT each, for a total of 10 mils AC DFT.
   Apply 2 coats ocean gray or black ablative AF @ 5 mils DFT each, for a total of 10 mils AF DFT.
   For 7 years service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils DFT each, for a total of 10 mils AC DFT.
   Apply 2 coats ocean gray or black ablative @ 6 mils DFT each, for a total of 12 mils AF DFT.
   For 10 years service life:
   Apply 2 coats anticorrosive of alternating color @ 5 mils DFT each, for a total of 10 mils AC DFT.
   Apply 3 coats ocean gray or black ablative AF @ 5 mils DFT each, for a total of 15 mils AF DFT.

Table 631-8-12 PAINT SYSTEMS FOR EXTERIOR WOOD SURFACES ON SURFACE SHIPS

Location	Paint System (Number of Coats and Formula No.)	Minimum DFT	Notes
Exterior horizontal surfaces and waterways; masts and spars	1 coat of aluminum paint 2 coats of MIL-E-24635, haze gray (color no. 26270) 1 coat of 150 2 coats of MIL-E-24635, haze gray (color no. 26270)	1.5 3 3 3	2,5,6 5,9,10
Accommodation ladders	4 coats of FED Spec. TT-V-119 spar varnish	6	- - -
Fittings	1 coat of aluminum paint 1 coat of MIL-E-24635, haze gray (color no. 26270)	1.5 1.5	6
Keel to upper boottopping	- - -	- - -	1,4,9,11,12
From the upper boottopping limit to main deck and all vertical and near vertical surfaces	1 mist coat of 150 1 coat of 151 1 coat of 150 2 coats of MIL-E-24635, haze gray (color no. 26270)	1-2 3 3 3	2,4,8,9,10
NOTES: See Table 631-8-10 for Notes.			

631-8.23.2.1 Inorganic Zinc Primers. The inorganic zinc primers called out in Table 631-8-10 are:

a. Post-Cure Type:
   1 Catha-Coat 300 - Devoe and Raynolds Co., Div. of Grow Chemical Corp.
   2 Rust-Ban 191/195 - Exxon Chemical Company.
   3 Zinciliate 101C - Industrial Metal Protective Company.

b. Self-Cure Type:
   1 Carbo-Zinc 11 or Carbo-Zinc - Carboline Marine Division.
   2 Galvosil 1570 - Hempel's Marine Paints.
   3 Metalhide 100 - Pittsburgh Plate Glass Company.
   4 Mobilzinc 13-F-12 or 13-F-6 (MZ-6) - The Valspar Company.
   5 Rust-Ban 191 or Rust-Ban 188.
   6 Zinc-ite B - Plas-Chem Corporation.
   7 Interzine QHA 027-025 (red), or Interzinc QHA 027-028 (green) - Courtaulds, Inc., International Paint Company.
   8 Quram 3365 WZ - Philadelphia Quartz Company.
   9 Zinc Prime 200 - Grow Chemical Company.
   10 BSP Vitazinc 2946 - Patterson-Sargent.
   11 Stancoat 711R - Standard Paint & Varnish Company.
   12 Farbozinc No. 76 and Farbozinc No. 114 - Farboil Company.
   13 Durazinc 500 - Southern Imperial Coatings Corporation.
   14 Pro-Zinc 202 or Pro-Zinc 221 - Proline Paint Company.

15 Briner Five-65 - Briner Paint Manufacturing Company.

16 Phillyzinc 1 - Philadelphia Resins Corporation.

17 SA-13446/SA-13447 - Andrew Brown Company.

18 Rel-Zinc No. 63 - (Gray/Green) - Reliance Universal, Inc.

19 Zincguard No. 3 - Seaguard Corporation.

20 Zinc-Lock 351 NF and Zinc-Lock 351 HF - Porter Paint Company.

21 Ganicin 347-Y-947 - E. I. DuPont de Nemours Company.

22 Napko 5-Z (High Flash) - Napko Corporation.

23 Dimetcote 6 and Dimetcote 9HF - Ameron Protective Coatings Division.

24 Zincguard No. 6 - Seaguard Corporation.

25 Mo-Zinc No. 4 (Gray 28-DH 51) and Mo-Zinc No. 5 (Green 28-DH-52) - Mobile Paint Manufacturing Company, Inc.

26 ByCo Zinc-Gard 102-SP - Bywater Coatings Company.

27 Catha-Coat 304 - Devote and Raynolds Co., Div. of Grow Chemical Corp.

28 IC 531 - Inorganic Coatings, Inc.

631-8.23.3 INTERIOR COMPARTMENTS. Interior painting (except in tanks, voids, and bilges) is not necessary when existing paints meet the requirements of this chapter and can be cleaned to the satisfaction of the Commanding Officer.

WARNING

Use a minimum number of thin coats of fire retardant coatings when repainting, and restrict repainting to those occasions when cleaning will not restore a pleasing finish. Even fire retardant coatings can contribute to fire spread when used in excessive thickness. This limit is exceeded at thicknesses in excess of 17 mils for DOD-E-24607 paints and in excess of 21 mils for the water-based fire retardant paints (DOD-C-24596) and in excess of 24 mils for Navy Formula 25A. Excessive thickness can also increase smoke and fume generation during a fire.

631-8.23.3.1 Approved Paint List. Unless otherwise specified in paragraph 631-8.23.5, the following paints are approved for unrestricted use in painting bulkheads and overheads of interior compartments which are considered manned spaces.

a. DOD-E-24607 solvent-based, chlorinated alkyd paints.

b. Products listed on DOD-C-24596 Qualified Product List (QPL).

c. NAVSEA-approved water-based fire retardant paints F-25A are as follows (this list is subject to modification as new companies are added in the future):

1 Courtaulds Inc.,

International Paint Co
Union, NJ 07083
Phone 201-686-1300

2 Devoe Marine Coatings
4600 DuPont Circle
Louisville, KY 40207
Phone 502-897-9861

3 Chemray-Seaguard Corp.
Portsmouth, VA 23701
Phone 804-488-4411

4 Hempels Coatings USA Inc.
Rutherford, NJ 07070
Phone 201-939-9411

5 The Valspar Corporation
Baltimore, MD 21230
Phone 410-625-7200

6 Mobile Paint Mfg Co. Inc.
Theodore, AL 36590
Phone 205-653-0110

7 Akron Paint & Varnish Co. Inc.
Akron, OH 44301
Phone 216-773-8911

8 Ocean Coating
Annapolis, MD 21401
Phone 301-261-2246

9 Ameron Protective Coatings
Marine Coatings Division
Brea, CA 92621
Phone 714-529-1951

10 Davlin Coatings Inc.
P.O. Box 2308
Berkeley, CA 94702
Phone 510-848-2863

11 Technical Coatings
P.O. Box 5848
Lubbock, TX 79408-5840
Phone 806-762-0871

631-8.23.3.2 Water-Based Coatings. Water-based coatings require ambient air and substrate temperatures above 50°F, in order for the water to evaporate completely and form a continuous coating. Where specific manufacturers allow use of their water-based paint below 50°F, the manufacturer's instructions may be followed. Water-based coatings require storage above 32°F. If water-based paints are used, exercise special care to ensure the surface preparation, primer application, primer cure, and water-based top coat application are properly performed. Water-based coatings may only be used over fully primed or painted steel substrates. Aluminum substrates do not require priming. Water-based coatings will not dry at relative humidity above 80 percent. Adequate ventilation or dehumidification will aid drying of water-based paints. Water-based coatings shall not be used where water condensation will occur before the paint dries.

631-8.23.4 INTERIOR COLOR SCHEMES. Type Commanders may specify uniform painting schemes for ships under their Command or may permit each ship to adopt its own color schemes. The choice of colors for living, messing, recreation, commissary, sanitary spaces, and adjacent passageways shall be restricted to those specified for decks, bulkheads, and overheads. A list of suggested color schemes is contained in NAVSEA 0929-LP-002-7010, U.S. Navy Shipboard Color Coordination Guidance Manual. The minimum reflectance of 70 percent is mandatory for overheads, except light traps. Reflectance may be determined by ASTM E97.

631-8.23.5 APPLICATION OF FIRE RETARDANT PAINTS. Water-based fire retardant coatings, qualified to DOD-C-24596 and Navy Formula 25A, are to be used for all applications where the ambient air and substrate temperatures are at or above 50°F, and relative humidity is less than 80 percent and in all normally manned spaces within the ships air conditioning boundaries. Shell bulkheads behind insulation (above and below the waterline) shall be coated with one coat each of Formulas 150, 151 and 152 (8 to 12 mils minimum DFT) prior to installation of insulation. Uninsulated shell bulkheads (above and below the waterline) shall be coated with one coat of Formula 150 and top coated with DOD-E-24607, DOD-C-24596 or Formula 25A paint. Spaces with bulkhead and overhead surfaces subject to condensation due to temperature differentials such as main machinery rooms, auxiliary boiler room, shaft alleys, pump rooms, catapult machinery rooms, piping trunks and ventilation ducting when condensing conditions exist on ducting surfaces during periods of paint out and curing, shall be painted with chlorinated alkyd-base paints, DOD-E-24607. Chlorinated alkyd-based coatings, DOD-E-24607 are to be used at ambient air temperatures below 50°F.

a. For other bulkheads and overheads, apply one coat of Formula 84 on steel or aluminum. Use two finish-coats of chlorinated alkyd-base paint (Table 631-8-13) or two finish coats of DOD-C-24596 fire retardant water-based paint, or two finish coats of other NAVSEA approved fire retardant water-based paints on bulkheads and overheads. Chlorinated alkyd-base paints are applied in the same way as conventional alkyd-base paint.

b. Apply one coat of Formula 84 and two finish-coats on decks.

c. Both sides of uninsulated fire zone bulkheads shall receive two coats at 5 mils DFT per coat of MIL-C-46081 to a minimum DFT of 10 mils over properly prepared and primed surfaces. Formula 150 is an acceptable primer.

d. Apply one coat of Formula 150 and one coat of Formula 152 to wet spaces such as washrooms, water closets, bath and shower spaces, sculleries, and vegetable preparation spaces. Apply as specified in Section 7 to achieve at least 5 mils DFT.

631-8.23.6 BULKHEADS AND OVERHEADS. Use water-base, DOD-C-24596 paint, chlorinated alkyd-based DOD-E-24607, or other NAVSEA approved fire retardant water-based paints, such as Navy formula 25A, for overheads and bulkheads of living, messing, and recreation spaces, and their connecting passageways. Paint fibrous glass board to match surrounding structure. Use interior finish water-based coatings as specified for interior compartments, bulkhead, and overheads. Finish-paint all other compartments according to Table 631-8-14, in which space and station names are segregated into functional groups as designated in the general specifications.

631-8.23.6.1 Interior Colors. Interior deck colors may be carried up onto the bulkhead, adjacent to the deck, to a height of approximately 6 inches. Where interior decks are tiled and corresponding bulkheads are light colored, a dark border to a height of approximately 6 inches or as defined by a ″natural″ border may be used to reduce the effect of bulkhead scuff marks. If tile is dark, color should approximate that of the tile. If tile is light-colored, a black border should be used. Paints listed in Table 631-8-14 may also be used for deck borders in spaces where rugs are installed. Interiors of weather doors may be finish-painted to match the surrounding bulkhead. Overhead colors may be carried down onto the adjacent bulkhead to a line at the level of the bottom of the overhead framing.

631-8.23.7 PAINTING BEHIND EQUIPMENT. Before installation of front-serviced electric, IC, FC, or electronics equipment, the bulkhead and deck area should be painted with two coats of primer, Formula 84 or two coats of Formula 150.

631-8.23.8 DECKS AND WALKING SURFACES. Decks for which coverings are specified do not require finish painting except where the deck covering consists of false decking, gratings, rugs, or portable material. See **NSTM Chapter 634, Deck Coverings** , for any other painting requirements.

631-8.23.8.1 Do not paint surfaces of aluminum or CRES. Give the bottoms and edges of steel floor plates in main and auxiliary machinery rooms two coats of Formula 84. Unless otherwise specified, finish-paint decks with gray MIL-E-24635, color number 36231.

Table 631-8-13 INTERIOR-FINISH PAINTS FOR SURFACE SHIPS AND SUBMARINES

Color[1]	Formula	FED-STD-595 Color No.	Specification	Notes
CHLORINATED-ALKYD BASE				
White	124	27880	DOD-E-24607	2,7
Pastel Green	125	24585	DOD-E-24607	3,7
Bulkhead-gray	126	26307	DOD-E-24607	3,7
Rose-wood	-	22519	DOD-E-24607	
Beach sand	-	22563	DOD-E-24607	
Yellow gray	-	26400	DOD-E-24607	
Green gray	-	26496	DOD-E-24607	
Pearl gray	-	26493	DOD-E-24607	
Sun glow	-	23697	DOD-E-24607	
Clipper blue	-	24516	DOD-E-24607	
Pastel blue	-	25526	DOD-E-24607	
WATER-BASE				
Pastel Green	-	24585	25A or DOD-C-24596	2,5,6
Bulkhead-gray	-	26307	25A or DOD-C-24596	2,5,6
White	-	27880	25A or DOD-C-24596	2,5,6
Beach sand	-	22563	25A or DOD-C-24596	2,4,5,6
Clipper blue	-	24516	25A or DOD-C-24596	2,4,5,6
Green gray	-	26496	25A or DOD-C-24596	2,4,5,6
Rose-wood	-	22519	25A or DOD-C-24596	2,4,5,6
Sun glow	-	23697	25A or DOD-C-24596	2,4,5,6
Yellow gray	-	26400	25A or DOD-C-24596	2,4,5,6
Pearl gray	-	26493	25A or DOD-C-24596	2,4,5,6
Pastel blue	-	25526	25A or DOD-C-24596	2,4,5,6

Table 631-8-14 SURFACE SHIP COMPARTMENT FINISHES

Compartment	Bulkheads (B) Overhead (O)	Notes
Air control and associated spaces:	Green, (B,O)	8,15
1. Air operations	Green, (B)	3,15
2. Air radio room	White, (O)	3
3. Carrier control, approach room	Gray, (B,O)	15
4. Other spaces	White, (B,O)	15
Commissary spaces	White, (B,O)	15
Damage control spaces:	Green, (B)	15
1. Central control station	White, (O)	15
2. Other spaces	White, (B,O)	
Electronic spaces:	Gray, (B,O)	2,15
1. Radar control room	Pastel Blue, (B)	2,15
2. Sonar control room	Insignia Blue, (O)	9
3. Outboard Ops. and Comms.	Green, (B)	9
4. Other spaces	White, (O)	9
Machinery and associated spaces	White, (B,O)	5,15
Fire control and gunnery spaces:	White, Formula 30 (B,O)	4,15
1. Gun mount enclosure	Green, (B)	7
2. Powder test room	White, (O)	15
3. Surface battery plot	Green, (B)	15
4. Underwater battery plot	White, (O)	15
5. Other spaces	Green, (B)	15
	White, (O)	
	White, (B,O)	
Flag spaces:	Gray, (B,O)	2,15
1. Flag planning center	Gray, (B,O)	2,15
2. Flag plot	Green, (B)	15
3. Flag radio center	White, (O)	15
4. Secondary flag planning	Green, (B,O)	15
5. Support control room	Green, (B,O)	2,15
6. Supporting arms coordination center	Gray, (B,O)	
Medical and dental spaces	Green, (B,O)	13,15,16
Offices	Green, (B)	15
	White, (O)	
Ship control and associated spaces:	Gray, (B,O)	2,15
1. Captain plot	Gray, (B,O)	2,15
2. Captain tactical message center	Green, (B,O)	2,15
3. Chart room	Gray, (B,O)	2,9,15
4. Combat Information Center (CIC)	Green, (B,O)	10,15
5. Pilot house	Green, (B,O)	15
6. Secondary conn	Green, (B)	15
7. Other spaces	White, (O)	
Workshops:	Green, (B,O)	8,15
1. Aviation photographic laboratory	Black, (B)	3,15
2. Welding bay	White, (O)	3
3. Print shop photographic darkroom	Green, (B)	15
4. Other spaces	White, (O)	15
	White, (B,O)	

Table 631-8-14 SURFACE SHIP COMPARTMENT FINISHES - Continued

Compartment	Bulkheads (B) Overhead (O)	Notes
Storerooms, issue rooms, and lockers	White (B,O)	15
Utility spaces: 1. Light traps 2. Other spaces	Black, (B,O) White, (B,O)	6 15
Sanitary spaces	White, (B,O)	11,15
Chemical Petroleum System (CPS) filter rooms, decontamination stations, and air locks	White, (B,O)	11,12,15

631-8.23.9 ACOUSTIC-ABSORPTIVE TREATED SURFACES. Surfaces treated with acoustical absorptive material shall be painted with one coat of paint (unless two coats are required to achieve hiding) to match surrounding structure. The paint shall be sprayed in a thin coat and care shall be taken to prevent the paint from bridging or sealing the perforations in the acoustical treatment.

631-8.23.10 TANKS, BILGES, AND VOIDS. Tanks, bilges, and voids shall be painted in accordance with Table 631-8-15. Treat wooden structures as specified in paragraph 631-8.3.2 and Section 9. Tanks covered by reactor plant painting schedules are not covered in Table 631-8-15. For tanks, the following preparation and painting protocol shall be followed.

631-8.23.10.1 Relative Humidity. For tanks, dehumidification equipment shall be used to maintain a maximum 50% relative humidity in the tank from prior to abrasive blasting through final curing of the topcoat. Blasted surfaces shall be maintained at a temperature that is at least 5°F above the dew point. Coatings shall be applied only when ambient conditions in the tank are as described in this manual or meet the requirements of the coating manufacturer’s instructions.

631-8.23.10.2 Preparations Before Abrasive Blasting. Before abrasive blast preparation, all welds shall have protrusions, projections, and spikes ground even with the weld profile; pits in the welds shall be ground out; all weld spatter shall be removed; radius all edges, flanges, cut-outs, angles, pipe hangers, and foot/hand holds to a minimum radius of 3 mm. Prior to blasting, remove all surface contaminants such as sea salts, grease, oil, loose rust, mud and marine growth with a 1000 psi minimum fresh water washdown. This shall be followed by an adequate period of time to allow the surface to dry prior to blasting.

631-8.23.10.3 Abrasive Blasting. Abrasive blast the tank with an approved abrasive blast medium qualified to the requirements of MIL-A-22262 and listed on the current qualified products list (QPL) 22262. The tank shall be blasted to achieve a Steel Structures Painting Council (SSPC) cleanliness standard of SP 10 - near white metal. After blasting, clean and remove all spent blast grit and paint residue from all surfaces of the tank. Special attention should be given to horizontal surfaces and the bottom of the tank where blasting material is likely to collect. Tank surfaces should be vacuumed to remove all dust. From this point on, personnel entering tanks shall wear coveralls and clean, disposable booties to minimize contamination of the surfaces to be painted, as well as to protect the painted surfaces.

631-8.23.10.4 Soluble Salt Measurements. After all preparation, blast cleaning, and clean-up are complete, the average surface profile shall be 2.0 to 4.0 mils and the tank surfaces (walls, stiffeners, etc.) shall show a maximum soluble salt contamination of 3 micrograms per square centimeter as measured by the cotton ball swab method of collection followed by titration or by the Bresle blister patch method. If any soluble salt measurement

exceeds 3 micrograms per square centimeter, re-blast the area until the soluble salt measurement is acceptable. For surface profile and soluble salt determination, 5 determinations shall be conducted every 1000 square feet. Areas less than 1000 square feet shall have 5 determinations made.

631-8.23.10.5 Fuel and Fuel-Seawater Ballast Tanks. For application to fuel/fuel-seawater ballast tanks, paint should be applied in accordance with Table 631-8-15 with the exception that the MIL-P-24441, Type IV system may be used (except in potable water tanks and feedwater tanks) as a two coat system. Formula 150 primer, Type IV may be applied up to 10 mils wet film thickness. The first coat of MIL-PRF-23236 paint shall be applied at the manufacturer's recommended thickness. After the first coat has cured, 2 stripe coats shall be applied, by brush, to all edges, weld seams, cut-outs, foot/hand holds, non-flat mounting hardware, and areas of complex geometries. Stripe coats shall be applied at 4 mils wet film thickness and extend outside the edge by 1 inch. Each stripe coat shall be of a different color than the coat (stripe or full) preceding or following it. Following the cure of the second stripe coat, apply the second coat of the coating system.

631-8.23.10.6 Seawater Ballast Tanks. In all surface ship seawater (salt water) ballast tanks, following blasting, clean-up, and soluble salt evaluation, a so-called ″edge retentive coating″ approved by NAVSEA shall be applied with a stripe coat. As of September 25, 1996, Sigma Coatings Company System, ″Sigmaguard 7404 Primer/7451 Topcoat″ is the only NAVSEA approved edge retentive coating. These coatings have been demonstrated to NAVSEA to retain on edges at least 65% of the film thickness found on flat surfaces. These coatings will be qualified to MIL-PRF-23236; however, in the interim, consult NAVSEA for the current approved sources.

631-8.23.10.7 Anodes. CRES, copper-nickel, monel, bronze, and other copper-bearing metals are frequently used for piping and for components placed in coated tanks. These metals act as strong cathodes in immersion conditions, causing galvanic corrosion to take place at gaps (holidays) in the painted tank surface (anode). Deep pits occur at paint holidays since small anodic steel surfaces are exposed to relatively large cathodes of corrosion-resistant bearing metal. To protect against galvanic corrosion in immersion conditions, both the pipes and components should be completely coated with the specified tank or bilge coating system, except where prohibited (paragraph 631-8.10).

Table 631-8-15 SURFACE SHIP TANK, BILGES, AND VOID COATINGS

Location	Paint System (Number of Coats and Formula No.)	DFT (mils)	Notes
Catapult gravity tank	1. 1 coat of 150 1 coat of 151 2 coats of 152 2. MIL-P-23236	2 to 4 2 to 4 2 to 4 (8 min total) - - -	1,2,6,9,12,24,25 1,2,6,9,12,13,25
Chain locker	1. 1 coat of 150 1 coat of 151 1 coat of 153 or 152 2. MIL-P-23236 3. NAVSEA approved inorganic zinc 1 coat of 150 (mist) 1 coat of 151 1 coat of 152 or 153	2 to 4 2 to 4 2 to 4 (8 min total) - - - 3 to 5 0.5 to 1 2 to 4 2 to 4 (9.5 min total)	1,6,7,12,25 1,6,7,12,13,25 1,6,7,12,13,25

Table 631-8-15 SURFACE SHIP TANK, BILGES, AND VOID COATINGS -

Continued

Location	Paint System (Number of Coats and Formula No.)	DFT (mils)	Notes
Drainage tanks, compensating fuel ballast tanks	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. MIL-P-23236	2 to 4 2 to 4 2 to 4 (8 min total) - - -	1,6,7,12,25 1,6,7,12,13,25
Nonfloodable voids	1. 1 coat of 150 1 coat of 152 2. MIL-P-23236 3. NAVSEA approved inorganic zinc 4. 1 coat of 150	2 to 4 2 to 4 (6 min total) - - - 3 to 5 3	1,6,7,10,12,25 1,6,7,10,12,13,25 1,6,7,10,25 1,6,7,10,12,25
Peak tanks	1. 1 coat of 150 2 coats of 152 or 156 2. MIL-P-23236	2 to 4 2 to 4 per coat (8 min total) - - -	4,6,11,12,25 1,2,6,7,12,13,25
Seawater tanks	1. MIL-P-23236	- - -	1,6,12,13,25
Collection, holding, and transfer tanks; sanitary tanks	1 coat of 150 1 coat of 156 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 2 to 4 (10 min total)	1,6,25
Small inaccessible voids	MIL-C-16173, Grade 1	- - -	3,10,25
Structure and fittings below floor plates in machinery spaces (bilges, bilge wells, and sumps, including bottoms and edges of floor plates)	1. 1 coat of 150 1 coat of 151 or 156 1 coat of 151 or 156 2. MIL-P-23236	2 to 4 2 to 4 2 to 4 (8 min total) - - -	5,12,15,25 12,13,15,25
Reserve feedwater tanks, reserve feed innerbottom tanks, freshwater drain collecting tanks (non-nuclear powered ships)	1. 1 coat of 150 1 coat of 151 1 or more coats of 152 2. NAVSEA - Approved coatings	2 to 4 2 to 4 2 to 4 per coat (8 min total) - - -	1,6,11,8,20,21,22,24,25 1,6,11,18,22
Reserve feedwater tanks, reserve feed innerbottom tanks, freshwater drain collecting tanks (nuclear powered ships)	1 coat of 150 1 coat of 151 1 or more coats of 152	2 to 4 2 to 4 2 to 4 (8 min total)	1,6,20,21,22,24,25
Tanks for jet fuel, gasoline, diesel fuel, fuel oil service, contaminated fuel; fuel or ballast tanks	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. MIL-P-23236	2 to 4 2 to 4 2 to 4 (8 min total) - - -	1,6,12,14,25 1,6,12,13,14,25

Table 631-8-15 SURFACE SHIP TANK, BILGES, AND VOID COATINGS -

Continued

Location	Paint System (Number of Coats and Formula No.)	DFT (mils)	Notes
Lubricating oil tanks	MIL-L-3150 Med (Lube Oil Preservative per General Ships Specifications)	- - -	- - -
Potable water and feedwater tanks (non-nuclear)	NAVSEA-approved coatings	- - -	6,18,23,25
Floodable but normally empty voids	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. MIL-P-23236 3. MIL-C-16173, Grade 1 4. 1 coat NAVSEA approved inorganic zinc	2 to 4 2 to 4 2 to 4 (8 min total) - - - - - - 3 to 5	1,4,6,7,12,15 1,4,6,12,13,25 3,4,12,25 - - -
Silicon bronze diesel fuel tanks	1. 1 coat of 150 1 coat of 151 1 coat of 152 2. MIL-P-23236	2 to 4 2 to 4 2 to 4 (8 min total) - - -	8,12,13,25 8,12,13,25
Locked-in freshwater ballast	NAVSEA-approved coatings	- - -	17,25
Hydraulic fluid tanks	MIL-L-3150 Medium (Lube Oil Preservative)	- - -	- - -

631-8.23.10.8 Proprietary Coatings. Proprietary coatings approved by NAVSEA shall be applied as recommended by the manufacturer or as stated in the paint specification. The minimum surface preparation standards for MIL-P-24441 coatings shall govern when they conflict with less thorough requirements in the manufacturer's instructions (paragraphs 631-8.8.3 through 631-8.8.5). NAVSSES shall be consulted for assistance with resolution of any other conflicts or ambiguities.

631-8.24 HOSPITAL SHIPS

631-8.24.1 Hospital ship exterior vertical surfaces above the waterline should have two finish-coats of white, MIL-E-24635, except areas designated for identifying ship name (paragraph 631-10.8.3). Weather decks covered with wood shall be unpainted, except for a square white area to be painted around the crosses. Steel weather decks outside of walking areas shall have two finish-coats of white MIL-E-24635, and walking areas of weather decks shall have two finish-coats of gray, MIL-E-24635, color number 26008. Outer smokepipe casing, booms, masts, and boats shall have two finish-coats of white, FED Spec. TT-E-490 or MIL-E-24635. A black band, FED Spec. TT-E-490 or MIL-E-24635, shall be painted around the smokepipe from the top to a depth of 1/3 of the fore-and-aft pipe dimensions.

631-8.25 SUBMARINES

631-8.25.1 EXTERIOR SURFACES. Coat the exterior surfaces in accordance with Table 631-8-16. NAVSEA-approved proprietary epoxy coatings for submarine exteriors are listed in Table 631-8-16. Vinyl anti-fouling paints and associated solvent thinners are highly flammable and are for exterior use only. Vinyl paints shall not be used within the pressure hull.

631-8.25.2 INTERIOR SURFACES. Interior painting (except tanks and bilges) is not necessary when existing paints meet the requirements of this chapter and can be cleaned to the satisfaction of the ship's Commanding Officer. Chlorinated alkyd base paints (see Table 631-8-13) shall be used as finish paints for overheads and bulkheads in engineering spaces such as engine rooms and machinery rooms. Surfaces behind insulation, which have the opposite side in contact with water or exposed to weather and where heavy condensation is common, shall be coated with one coat each of Formulas 150, 151, and 152 (8 to 12 mils minimum DFT) prior to installation of insulation. Uninsulated areas of steel structure, which have the opposite side in contact with water or exposed to weather and where heavy condensation is common, shall be coated with one coat of Formulas 150, 151, and 152 or one coat of Formula 150 and top coated with DOD-E-24607. If the existing coatings show excessive film defects such as cracking, peeling, and flaking, clean the entire surface to bare metal and repaint, using the appropriate procedure. Water-based fire retardant coatings, DOD-C-24596 and Navy Formula 25A, are to be used for all applications, other than engineering spaces, where the ambient air and substrate temperatures are at or above 50°F and relative humidity is less than 80 percent and areas as specified in paragraph 631-8.25.2. Chlorinated alkyd-base coatings, DOD-E-24607, may be used at ambient air temperatures below 50°F in accordance with paragraph 631-8.25.2.

Table 631-8-16 SUBMARINE EXTERIOR SURFACE COATING SYSTEMS

Location	Paint System (Number of Coats and Formula No.)	Minimum DFT (mils)	Notes
Keel to waterline in maximum condition diving trim; rudders and struts and diving planes	- - -	- - -	1,2,9
Wood slat decking	1 coat of 153	3	
Exterior aluminum	1 coat of 150 1 coat of 151 or 150 1 coat of 153, 154 or 155	2 3 3	8,9,10
Air induction piping	1 coat of NAVSEA approved inorganic zinc	3 to 5	7
Exterior topsides	1. 1 coat of 150 1 coat of 151 or 150 1 coat of 153, 154 or 155 2. 2 or 3 coats of NAVSEA approved epoxy	3 3 3 8	4,5,6,9,10 3,4,5,6,9,11

WARNING

Use a minimum number of thin coats of fire retardant coatings when repainting and restrict repainting to those occasions when cleaning will not restore a pleasing finish. Even fire retardant coatings can contribute to fire spread when used in excessive thickness. This limit is exceeded at thicknesses in excess of 17 mils for DOD-E-24607 paints and in excess of 21 mils for the water based fire retardant paints (DOD-C-24596) and NAVSEA approved products). Excessive thickness can also increase smoke and fume generation during a fire.

631-8.25.2.1 Paint Suppliers. The following paints are approved for unrestricted use in painting bulkheads and overheads of interior compartments (outside of engineering spaces) which are considered manned spaces:

a. DOD-E-24607 solvent based, chlorinated alkyd paints.

b. Products listed on DOD-C-24596 qualified products list (QPL).

c. Presently, NAVSEA approved water-based fire retardant paints Formula 25A are as follows (this list is subject to modification as new companies are added in the future):

1 Courtaulds Inc.
International Paint Co.
Union, NJ 07083
Phone 201-686-1300

2 Devoe Marine Coatings
Louisville, KY 40207
Phone 502-897-9861

3 Chemray-Seaguard Corp.
Portsmouth, VA 23701
Phone 804-488-4411

4 Hempels Coatings USA Inc.
Rutherford, NJ 07070
Phone 201-939-9411

5 The Valspar Corporation
Baltimore, MD 21230
Phone 410-625-7200

6 Mobile Paint Mfg. Co. Inc.
Theodore, AL 36590
Phone 205-653-0110

7 Akron Paint & Varnish Co. Inc.
Akron, OH 44301
Phone 216-773-8911

8 Ocean Coating
Annapolis, MD 21401
Phone 301-261-2246

9 Ameron Protective Coatings
Marine Coatings Division
Brea, CA 92621
Phone 714-529-1951

10 Davlin Coatings Inc.
P.O. Box 2308
Berkeley, CA 94702
Phone 510-848-2863

11 Technical Coatings Inc.
P.O. Box 5848
Lubbock, TX 79408-5848
Phone 806-762-0871

631-8.25.2.2 Water-Based Coatings. Water-based coatings may only be applied when ambient air and substrate temperatures are above 50°F, in order for the water to evaporate completely and form a continuous coating. Where specific manufacturers allow use of their water-based paint below 50°F, the manufacturer's instructions may be followed. Water-based coatings require storage above 32°F. If water-based paints are used, exercise spe-

cial care to ensure the surface preparation, primer application, primer cure and water-based topcoat application are properly performed. Water-based coatings may only be used over fully primed or painted steel substrates; do not apply to bare steel substrates. Aluminum substrates do not require priming when painting with water-based paints. Water-based coatings will not dry at relative humidity above 80 percent. Adequate ventilation or dehumidification will aid drying of water-based paints. Water-based coatings shall not be used where water condensation will occur before the paint dries.

CAUTION

To minimize premature yellowing, chlorinated alkyd-based paints shall not be applied within 4 weeks before and after the application of amine-cured epoxy paints. The vapors from the epoxies can come in contact with the chlorinated alkyd paints and cause yellowing. Amine-cured paints include some MIL-P-23236 tank and bilge coatings.

a. Apply one coat of Formula 84. Use two finish-coats of chlorinated alkyd-base paint or fire-retardant water-based paint on bulkheads and overheads. Chlorinated alkyd-base paints and fire-retardant water based paints are listed in Table 631-8-13 and are applied in the same way as conventional alkyd-base paints or water-based paints.

b. Apply one coat of Formula 84 and two finish-coats on decks. Where topcoat color is satisfactory (for example, Formula 156 on a red deck), deck surfaces prepared to bare metal may be coated with Formula 150 primer and Formula 156 topcoat for improved durability. For special precautions when Formula 150-series coating applications may vent to a space containing motor generators, see paragraph 631-8.25.6.

c. Hull insulation shall be applied according to **NSTM Chapter 635, Thermal, Fire, and Acoustic Insulation** . Metal surfaces shall be primed with one coat (3 mils minimum DFT) of Formula 150, before installation of insulation. Cork and polyvinyl chloride (PVC) hull insulation, MIL-P-15280, shall be painted with the OCEAN 634/9788 (Ocean Chemical Co., Savannah, GA) coating system in accordance with the manufacturer's instructions. The 3-coat OCEAN 634/9788 system consists of the following coatings:

   1 1 coat of OCEAN 634 Prime Coat, with a minimum of 2 mils DFT.

   2 2 coats of OCEAN 9788 Intumescent Fire-Retardant Paint with a minimum of 10 mils DFT (5 mils minimum DFT per coat).

NOTE

Use of any alternative to the OCEAN 634/9788 system requires specific NAVSEA approval.

d. Apply one coat each of Formula 150 and 152 to wet spaces; for example, washrooms, water closets, bath and shower spaces, sculleries, and vegetable preparation spaces. Apply as specified in Section 7 to achieve at least 5 mils DFT. For special precautions when Formula 150-series coating applications may vent to a space containing motor generators, see paragraph 631-8.25.6.

631-8.25.3 COMPARTMENT FINISH. Compartments shall be finish-painted in accordance with these specifications:

1. Paints listed in Table 631-8-13 shall be used for bulkheads and overheads, unless other materials are approved by NAVSEA.
2. Type Commanders may specify uniform painting schemes for ships under their Command or may permit each ship to adopt its own scheme.
3. Decks for which coverings are specified do not require finish-painting, except where the deck covering consists of false deckings, gratings, rugs, or portable material. Epoxy finish paints shall not be applied over previously applied non-epoxy paints.
4. Finish-paints for built-in steel furniture shall match the surrounding structure.
5. Finish-paint battery compartments with two coats of white formula 124, except for the rubber lining (**NSTM Chapter 634, Deck Coverings**).
6. Unless otherwise permitted by Type Commanders, finish-paint radio room yellow-gray on overhead bulkheads and furniture surfaces, and green-gray on apparatus panels, cabinets, and racks.
7. As an alternative to Formula 111 machinery gray, the use of the paints listed in Table 631-8-17 is approved for specified surfaces in submarine engine rooms when prescribed by the Type Commander.
8. For pre-SSN 688 Class submarines, Type Commanders shall limit paint color selection for general painting of engineering spaces to white (Formula 124), pastel green (Formula 125) and bulkhead gray (Formula 126). Repainting solely to meet these color requirements is not required. Painting of decks and bilges shall be accomplished as currently specified in applicable directives.

Table 631-8-17 SUBMARINE ENGINE ROOM PAINTS

Color	FED-STD-595 Color No.	Surfaces
Clear Blue, FED Spec. TT-E-489	15177	Switch boxes, distribution panels, electric starting panels, and start-stop switches
Vivid orange, FED Spec. TT-E-489	12246	Purifier belt covers and other rotating machinery
Brilliant yellow, FED Spec. TT-E-489	13538	Underside or deck access hatches
Machinery gray, Formula 111	To match Formula 111	Other equipment including engines, generators, coolers, and purifiers

631-8.25.4 TORPEDO TUBES. Coat the steel surfaces of torpedo tubes of the SS-563 Class, SSN-571 Class, and other submarines built with ferrous torpedo tubes with either the Class 1 (epoxy) coatings specified in MIL-P-23236 or the preferred three-coat MIL-P-24441 epoxy-polyamide coating system. Apply coatings as specified for tanks in Table 631-8-18.

631-8.25.5 SPECIAL SUBMARINE PAINTING REQUIREMENTS. The special requirements covered in the following paragraphs shall be observed when painting the interior of a submarine. Coating systems different than those required by non-deviation drawings shall have specific NAVSEA approval before application.

631-8.25.5.1 Paint Application. All painting with specified organic solvent-thinned oil based or epoxy paints that exceeds 1 quart of paint per day for the entire ship shall be completed at least 5 days before departure. For additional requirements for Formula 30 white enamel, DOD-E-1115, and FED Spec. TT-P-28 heat-resistant paint, see Section 2.

NOTE

The date of departure, as it relates to painting, shall be the date of the first dive after departure for a period of operation. The Commanding Officer of the submarine shall determine the date of departure whenever the question arises.

631-8.25.5.1.1 Painting shall be done at sea only after the last dive on return from patrol.

631-8.25.5.2 Touch-Up Painting. When touch-up painting or other small amounts of painting shall be completed within 5 days before departure, it shall be done with the specified solvent-base paint, not exceeding 1 quart of paint per day for the entire ship and exhausting to the weather. Where this procedure is not practical and painting is considered necessary, water-base paints may be used instead of chlorinated alkyd paints (Formula 124). The water-base paints allowed are:

a. Water-based paints qualified to DOD-C-24596.

b. Navy Formula No. 25A - Consult NAVSSES if questions arise.

631-8.25.5.3 Painting of Thermal Surfaces. After painting of any piping or lagging subject to heating during system operation, that system should (whenever practical) be activated (heated) at dockside or before submerging, while exhausting to the weather.

Table 631-8-18 SUBMARINE TANK, BILGES AND VOID COATINGS

Location	Paint System (Number of Coats and Formula No.)	DFT (mils) Minimum	Notes
Bow buoyancy and main ballast tanks	1 coat of 150 1 coat of 151 1 coat of 152 plus 2 coats of 121 to 2 feet above tank opening	2 to 4 2 to 4 2 to 4 (8 min total) 2 min/coat	2,3,5,7,16,17
Fuel oil ballast and expansion tanks; negative tank and safety tank	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	1,2,5,7,17
Fuel oil filter sump drain tank (SSN-688 class)	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	1,2,5,7,17
Chain locker	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	2

Table 631-8-18 SUBMARINE TANK, BILGES AND VOID COATINGS -

Continued

Location	Paint System (Number of Coats and Formula No.)	DFT (mils) Minimum	Notes
Clean fuel tanks	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	2,18
Water round torpedo, trim, auxiliary, depth control, torpedo impulse, and torpedo tube drain tanks	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	1,2,5,7,17
Collecting fuel oil, and variable fuel oil tanks; poppet valve drain tank, fuel oil overflow tank	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 (8 min total)	1,2,7,17,18
Lubricating oil sumps, lubricating oil stowage tanks, hydraulic oil tanks, lubricating oil collecting/settling tank, and lubricating oil sludge tank	None	- - -	- - -
Sanitary tanks	1 coat of 150 1 coat of 156 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 2 to 4 (10 min total)	1,2,7
Potable water	See Table 631-8-4	- - -	1,2,7,11,15
Surge tanks	2 coats of Apexior No. 1 (Dampney Co.)	3	- - -
Hovering tank	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4	- - -
Bilges, drainage trenches, missile tube eject chamber, and missile compensating tanks	1 coat of 150 1 coat of 151 or 156 1 coat of 151 or 157	3 3 3	1,4,7,8,9,10,14,17
Bilge collecting tanks/sumps, dirty drain collecting tanks, non-oily drain collecting tanks, oily drain collecting tanks, waste oil collecting tanks, non-oily bilge collecting tanks, and oily bilge collecting tanks	1 coat of 150 1 coat of 151 or 156 1 coat of 157 or 151	3 3 3	1,4,7,8,9,17
Reserve feedwater tanks, fresh water drain collecting tanks, normal fuel oil tanks	1 coat of 150 1 coat of 151 1 coat of 152	2 to 4 2 to 4 2 to 4 per coat (8 min total)	1,2,4,7,11,12,13,18

Table 631-8-18 SUBMARINE TANK, BILGES AND VOID COATINGS -

Continued

Location	Paint System (Number of Coats and Formula No.)	DFT (mils) Minimum	Notes
Inaccessible voids	MIL-C-16173	Heavy	Safety Precautions. Paragraphs: 631-2.2, 631-2.2.13, and 631-2.5. See Section 2

631-8.25.5.4 Ventilation. Exhaust ventilation to the weather, with a rate of at least 20 changes per hour, shall be maintained during all painting (except for limited touch-up, as described in paragraph 631-8.25.5.2). When painting is completed, any compartment in which painting was done shall be ventilated to the weather for at least 24 hours. Change carbon filters before departure.

631-8.25.6 PROTECTION OF MOTOR GENERATORS DURING PAINTING. Motor generators require protection from paints conforming to MIL-P-24441 (Navy epoxy Formula 150 series), MIL-P-23236, or NAVSEA fresh-water tank coating requirements (except Formula 102) during application and curing of the paint. When these paints are being applied or cured while venting in a space containing motor generators, the motor generators shall be protected using a NAVSEA approved procedure. For 300-kW and 500-kW motor generators, a positive pressure unit, according to the latest revision of Life Cycle Engineering Drawing 53711-307-5390492, shall be used. Consult NAVSEA to resolve any questions about adequacy of protective procedures for motor generators.

631-8.25.7 SUBMARINE TANKS, BILGES, AND VOIDS. Paint submarine tanks, bilges, and voids in accordance with paragraphs 631-8.23.10 through 631-8.23.10.8 and in accordance with specifications given in Table 631-8-18. Provisions in the table do not apply to tanks covered by reactor plant painting schedules of nuclear-powered ships.

631-8.25.8 SSBN MISSILE LAUNCH AIR-EJECT PIPING. Before leaving the shipyard, all missile tubes, eject piping, and eject changers shall be inspected to ensure that they are clean, dry, and free of corrosion. Preserve as necessary with specified coatings.

631-8.25.9 FRESH-WATER CLEANING. Immediately after draining tubes which were flooded with seawater, flush tubes and eject piping with fresh water (tap water is satisfactory) to remove salt deposits. In eject piping, use hose without metal fittings (or with fittings adequately protected) to prevent coating abrasion, and insert the hose from the eject changer up to the launch valve to flush the entire pipe. Pressurize the valve dome during flush operations to prevent water entry into the launch valve. Personnel should use rubber-soled shoes to prevent coating damage in the eject chamber.

631-8.25.10 TUBE AND EJECT PIPING DRYING. Dry tube and eject piping surfaces thoroughly by swabbing, followed preferably by circulating dry air heated from 38 to 60°C (100° to 140°F). If shore compressors

are used, fit the compressed air system with water-removing traps and filters, dehumidifiers, and heaters, if practicable. Air from submarine flasks is also considered satisfactory. Circulation of a fresh supply of unheated air will also reduce drying time.

631-8.25.11 INSPECTION AND MAINTENANCE. Inspect tubes and eject piping for corrosion and loss of coating adhesion. If extensive corrosion exists, mechanically clean as necessary, and vacuum. Apply a thin film of corrosion preventive MIL-C-16173 (NSN 8030-00-244-1298) in eject pipe to maximum practical extent. A flexible shaft is recommended, using a wire brush for cleaning and a swab for coating the eject pipe.

631-8.25.11.1 Touch Up Painting. Touch up eject chamber and torus ring with previously applied coating type. Ventilate to the weather, if required, to remove solvent. In view of the comparatively small area involved, any solvent retained in the film after drying 4 hours with ventilation should not cause significant atmospheric contamination. If the corrosion or loose paint is minor, to the point that the possibility of damage from dislodgment would be negligible, the eject piping may be swabbed with metal conditioning compound (MIL-C-22235) without prior cleaning and subsequent ventilation.

631-8.25.11.2 Protect Sensitive Parts. In flushing, drying, and represerving the air eject piping system, a positive means of protecting first-stage jetevators and missile components from dust and mechanical damage shall be provided. During subsequent maintenance, the eject piping shall be inspected, flushed, and dried as specified in paragraphs 631-8.25.8 through 631-8.25.10.

SECTION 9.

BOATS AND SMALL CRAFT

631-9.1 GENERAL

631-9.1.1 OVERVIEW. After adequate surface preparation, surfaces of boats and small craft, except inflatable boats as described in **NSTM Chapter 583, Boats and Small Craft** , shall be coated according to one of the procedures described in this section.

631-9.2 ABOVE-WATER SURFACES

631-9.2.1 PAINTED WOOD. Prime painted wood with one coat of aluminum paint prepared by mixing 2 pounds of aluminum paste, FED Spec. TT-P-320, Type II, Class 2, into 1 gallon of spar varnish, FED Spec. TT-V-119. Apply two coats of the appropriate colored finish paint.

631-9.2.2 UNPAINTED WOOD. To unpainted wood, apply any necessary wood filler, FED Spec. TT-F-336, stain with either Formulas 49, 50, 51, 52, or 54, if desired, and finish with four coats of spar varnish, FED Spec. TT-V-119. Surfaces below the floor or walking flat levels, forepeaks, and transom compartments should not be painted, but should be treated with a heavy coat of wood preservative, MIL-W-18142.

631-9.2.3 METAL On metal surfaces, use two coats of primer, Formula 84, and two coats of finish paint. Only one priming coat and one finishing coat are required for surfaces not exposed to the weather.

631-9.2.3.1 Surface Preparations. Ferrous surfaces on the topsides of wood landing craft should be abrasive-blasted and given one coat of a NAVSEA-approved zinc-rich primer and topcoated as specified in Table 631-8-10 with a suitable color. Information on approved inorganic zinc primers is given in paragraph 631-8.23.2.1.

631-9.2.3.2 Corrosion Prevention Inner surfaces of voids of small steel landing craft (where surface preparation and paint application are difficult) should be coated with thin-film corrosion preventive, MIL-C-16173, Grade 1.

631-9.2.4 PLASTIC. Where finish paint is required for color, plastic surfaces shall receive one coat of Formula 150 and two coats of finish paint. Painting is not required where the color of plastic is satisfactory.

631-9.2.5 ALUMINUM. Detailed painting instructions for aluminum boats and small craft are presented in NSTM Chapter 583.

631-9.3 UNDERWATER SURFACES

631-9.3.1 ALUMINUM BOAT ANTI-FOULING (AF) COATINGS. NAVSEA approved proprietary products approved for use on aluminum boat underwater hulls and boot toppings are listed in Table 631-8-3. Refer to NSTM Chapter 583 for a detailed discussion on aluminum boats.

NOTE

Do not use Formula 121, 129, or other copper-bearing AF paints on aluminum boats.

631-9.3.2 STEEL BOAT PRIMERS. After adequate surface preparation, apply one of the following paint systems to underwater ferrous metal surfaces:

a. One coat each of Formulas 150, 151, and 154, or three coats of Formula 150, applied to a total minimum dry film thickness (DFT) of 9 mils.

b. Apply finish coats as specified in paragraphs 631-9.3.4.2 through 631-9.3.5.1.

631-9.3.3 WOOD BOAT PRIMERS. Boats dry-berthed on shore need not be primed. For other boats, wood surfaces treated with wood preservation and plastic surfaces should receive one coat of primer (Formula 150) and finish paints as specified in paragraphs 631-9.3.4.1 through 631-9.3.5. Untreated wood surfaces do not require pretreatment.

631-9.3.4 FINISH COATS. Prime steel and wood surfaces as specified. Apply finish coats for underwater surfaces according to information given in the following paragraphs.

631-9.3.4.1 Boats Dry-Berthed on Shore. The bottoms of metal or plastic boats that are dry-berthed on shore shall be appropriately finish-coated when placed in service. Wood boats, dry-berthed on shore, shall receive two coats of black paint, MIL-E-24635.

631-9.3.4.2 Boats Wet-Berthed in Fouling Waters. Apply two coats of vinyl AF paint (Formula 121) to the bottoms of boats that are wet-berthed in fouling waters. Alternatively, a 5-year underwater hull coating system can be used. See Table 631-8-2.

631-9.3.4.3 Boats Stored on Ships in Service. Based on intended use, the bottoms of boats that are stored on ships in service shall receive two coats of black AF paint (Formula 129) or the coatings specified in the following paragraphs.

631-9.3.4.4 Boats Issued for Individual Use of Flag-Rank Officers and Boats Issued to Hospital Ships. Two coats of medium green paint MIL-E-24635 shall be applied to the bottoms of small boats that are issued for the individual use of flag-rank officers and boats that are issued to hospital ships.

631-9.3.4.5 Boats Operating in Non-Fouling Waters. Two coats of black paint MIL-E-24635 shall be applied to the bottoms of boats that are operating in non-fouling waters.

631-9.3.5 EXTENT OF BOTTOM FINISH COAT. The bottom finish coat should extend from the keel to the painted waterline which is scribed in the hull or 12 inches above the normal waterline. The normal waterline is defined as the waterline at which the boats will float under the following loading:

a. **Pulling boats** . Full outfit and carrying maximum number of persons permitted.

b. **Power boats** . Full outfit, fuel, and carrying 1/2 the maximum number of persons permitted.

631-9.3.5.1 Painting Around Fenders. Where a structural fender is approximately tangent to the upper limit of the bottom paint, the bottom paint system may be modified. It may be carried up to and may follow the lower side of the fender if modifying the bottom paint in such a manner improves the appearance of the boat.

631-9.4 MISCELLANEOUS EQUIPMENT

631-9.4.1 HOOKS, OARS, AND STAFFS. Boat hooks, oars, and boat flag and pennant staffs should be varnished in natural wood.

631-9.4.2 CANVAS CANOPIES. Canvas canopies shall be painted on the outside with canvas preservative, FED Spec. TT-P-595. The undersides of canvas canopies should not be painted. All other canvas, such as curtains for cockpits and gangway, should not be painted.

631-9.4.3 RUNNING-LIGHT BOXES. Side running-light boxes shall be finish-painted black MIL-E-24635, on their inner surfaces. Outer surfaces should be painted to match the surrounding structure.

631-9.4.4 FIRE EXTINGUISHING SYSTEM. Carbon dioxide fire extinguisher cylinders shall be finished with red striping, MIL-E-24635. All operating parts should be left bright, especially the valve and the distant control gear on built-in units. Piping (except nozzles) should be painted to conform with the colors of adjacent bulkheads. Special care shall be taken to keep discharge nozzles free of paint.

631-9.5 OPEN BOATS

631-9.5.1 PAINTED SURFACES. Surfaces other than the underwater bodies of pulling boats, motor launches, utility boats, and motor whaleboats shall receive a finish coat of haze gray, silicone alkyd enamel MIL-E-24635, except as otherwise specified.

631-9.5.2 VARNISHED SURFACES. The parts of pulling boats, motor launches, utility boats, and motor whaleboats that shall be given four coats of spar varnish (FED Spec. TT-V-119) are:

a. Wood awning stanchions.

b. Backboards.

c. Capping and clamp at gunwale (except clamps made of yellow pine, which should be painted according to paragraph 631-9.5.1).

d. Fecks and flats at level of gunwales.

e. Flagstaffs.

f. Platforms on level of thwarts.

g. Stretchers.

h. Structural fenders on gunwale (half-round or built-up).

i. Thwarts.

j. Tillers.

k. Tops of rudders above lower edge of fender at gunwale.

l. Towing posts.

631-9.5.3 UNPAINTED SURFACES. Unpainted surfaces such as bitts, chocks, cleats, cutwater, brass fender facings, transom angles, frame clips, breasthooks, caps for shaft logs, lifting pads, and engine exhaust pipes shall be left bright.

631-9.6 CABIN BOATS

631-9.6.1 PAINTED SURFACES. The outside hulls of cabin boats, between the level of the deck and the underwater portion, shall receive a finish coat of haze gray, silicone alkyd enamel, MIL-E-24635, except as otherwise specified.

631-9.6.1.1 Motorboats for Flag Officers. Motorboats assigned for the individual use of flag-rank officers shall be finish-painted black (MIL-E-24635) on the outside of the hulls between the level of the decks and the underwater portions.

631-9.6.1.2 Internal Painting. Closed-in compartments that are not exposed to view from the outside shall be finished with white (Formula 30) down to the level of the floors or walking flats.

631-9.6.2 UNPAINTED SURFACES. Surfaces below the level of the floors or walking flats, forepeaks, and transom compartments shall not be painted, but shall be treated with a heavy brush coat of wood preservative, MIL-W-18142.

631-9.6.3 VARNISHED SURFACES. The cabin boat parts that shall be given four coats of varnish (FED Spec. TT-V-119) are:

a. Benches
b. Coamings
c. Cockpits
d. Decks
e. Gunwales
f. Locker tops
g. Waterways
h. Woodwork above deck level
i. Main bulkheads which can be seen at a distance from the outside, except those already coated with paint.

631-9.6.4 BRASS SURFACES. Brass fittings, such as rails, port rims, voice tubes, cleats, bells and bell brackets, and the steering wheel shall be left bright.

631-9.6.4.1 Painting of Brass and Copper. The exterior of brass and copper ventilator cowls on motorboats assigned to flag-rank officers shall be left bright. Brass ventilator cowls on other motorboats should be painted on the outside, but the rim should be polished. The ventilator cowls on the inside should be finish-painted red, MIL-E-24635.

631-9.6.5 ALUMINUM SURFACES. Aluminum canopies and fittings shall be painted as described in NSTM Chapter 583. Metal hoods and spray shields should be finish-painted on the outside with haze gray, silicone alkyd enamel, MIL-E-24635, except on flag-rank boats used as barges and gigs and hospital ship boats, where they should be white (Formula 30). The inside of all hoods should be finish-painted with white (Formula 30).

631-9.7 BOATS FOR HOSPITAL SHIPS

631-9.7.1 PAINTING BOATS FOR HOSPITAL SHIPS. Boats on hospital ships shall be finish-painted white (Formula 30). The white area shall include the side planking (except the underwater body which is painted according to paragraph 631-9.3.4.5), the transom, and the inside of the hull down to the footings or walking flats. On closed motorboats, the interior shall be painted with white (Formula 30). The cockpits and other parts ordinarily finished bright on other boats shall be finished bright on boats for hospital ships. Surfaces below the level of floors or walking flats shall not be painted, but shall be treated with a heavy brush coat of wood preservative, MIL-W-18142. Identification shall be as specified in paragraph 631-10.8.3.

631-9.8 IDENTIFICATION MARKINGS

631-9.8.1 NSTM CHAPTER 583. NSTM Chapter 583 gives instructions for proper identification markings.

631-9.9 SEARCH AND RESCUE BOATS (AVRS).

631-9.9.1 LARGE AVRs. All 63-foot, 45-foot, and 40-foot boats used for AVRs should be painted according to this section.

a. Two coats of vinyl AF paint (Formula 121) should be used to paint the underwater wood hulls.

b. Hulls (except underwater areas) shall be painted with white enamel, MIL-E-24635.

c. Weather decks shall be painted with a brilliant yellow enamel (FED-STD-595, color no. 13538, MIL-E-24635).

d. Exposed painted surfaces above weather decks shall be painted with international orange enamel (FED-STD-595, color no. 12197, MIL-E-24635).

e. Wood surfaces not required to be painted and inside trim shall be finish-painted with four coats of varnish (FED Spec. TT-V-119).

f. Distinguishing figures (call sign identification) shall be painted with black (MIL-E-24635) using figures of suitable size and location to be visible from the air.

631-9.9.2 SMALL AVRs. All 19-foot AVRs shall be painted according to this section, with these finish-paint exceptions:

a. Hulls (except underwater body and above gunwale) shall be finish-painted with white enamel (MIL-E-24635).

b. All surfaces requiring painting above the gunwale shall be finish-painted with international orange enamel (FED-STD-595, color no. 12197, MIL-E-24635).

631-9.9.2.1 Remove Existing Coatings Previously existing coatings should be removed before application of finish coatings. Surface preparation and manner of application shall be according to manufacturer's instructions.

631-9.10 PLASTIC BOATS

631-9.10.1 SURFACE PREPARATIONS AND PAINTING. Prepare plastic boat surfaces for painting by removing contaminants and abrading the surface to ensure paint adhesion. Care should be taken so that none of the fiberglass underlay is damaged. Apply one coat of Formula 150, and two finish coats, as specified for the boat type. Underwater surfaces shall be painted according to paragraphs 631-9.3.4.1 through 631-9.3.5 except that anti-corrosive (AC) paint is not required.

SECTION 10.

NAVAL SHIPS' MARKING AND AWARDS

631-10.1 GENERAL

631-10.1.1 OVERVIEW. The contents of this section shall be used as a guide for the size, painting, placement of naval ship and small craft names, identification markings, and awards.

631-10.2 SHIP NAMES

631-10.2.1 SHIP NAME LOCATION. Ship names shall be painted in black (MIL-E-24635) as prescribed by the Force Commanders. If practical, it is recommended that the name be painted in 12-inch letters directly on the stern at the centerline in a suitable location below the main deck. NAVSEA drawing No. S2804-0860347 may be used as a guide for letter style. On ships with sharp sterns, or interferences in the stern area, the name should appear on each quarter.

631-10.3 SHIP NAMEBOARD

631-10.3.1 NAMEBOARD LETTERS. Nameboard letters shall be 6 inches high and 3/16 inch thick according to NAVSEA drawing No. 220598. Letters should be secured with brass wood screws. Letters may be procured locally through open purchase.

631-10.3.2 NAMEBOARDS. Nameboards shall be varnished mahogany, and shall be approximately 9 inches wide and 1-1/4 inches thick. They shall be attached port and starboard in a suitable location on the side of the bridge or at the rail.

631-10.4 DRAFT MARKS

631-10.4.1 COLOR AND LOCATION. Draft marks shall be black (MIL-E-24635) above the upper limit of the boot topping, and white (MIL-E-24635) below.

631-10.5 DISTINGUISHING NUMERALS AND LETTERS

631-10.5.1 EXCEPT AIRCRAFT CARRIERS. Distinguishing numerals and letters shall be painted as required by the NAVSEA drawing no. listed in Table 631-10-1, except as modified for aircraft carriers.

631-10.5.1.1 Aircraft Carriers. Flight deck markings on aircraft carriers shall be according to the applicable Visual Landing Aids General Service Bulletin. The area within a boundary of 24 inches adjacent to each high-thrust tiedown shall be painted with red striping paint (Formula 40) and stenciled FOR HIGH THRUST ENGINE TURN-UP.

631-10.6 LETTER AWARDS

631-10.6.1 GENERAL. Letters awarded the ship shall be painted on as prescribed by Fleet Commanders, who will also designate the locations and sizes. If desired, the locations and sizes in Table 631-10-2 may be used as a guide. Letters should be block type, shaded on the left side and lower edges with black FED Spec. TT-E-489, color 17038 as shown on NAVSEA drawing S2804-921819.

631-10.6.2 ENGINEERING AWARD. When the ship receives an engineering award, it is recommended that the award letter be painted on each side of the forward stack. It shall be located with the top edge of the letter 1/2 the stack diameter below the top of the stack and the center of the letter on the centerline, and with the same rake as the stack. The height of the letters shall be 1/2 the stack diameter.

Table 631-10-1 DISTINGUISHING NUMERALS AND LETTERS

Title	NAVSEA Drawing Number
Distinguishing figures for battleships and cruisers	S-2804-921791
Distinguishing figures for destroyers, destroyer escorts, and type conversions	S-2804-860345
Figures for distinguishing marks on submarines	S-2804-860346
Distinguishing figures for mine craft	S-2804-921769
Distinguishing figures for landing craft	S-2804-921783
Distinguishing figures and special insignia for AVP's and ASR's	S-2804-860342
Distinguishing figures and special insignia for light mine layers (DM)	S-2804-86043
Distinguishing figures and special insignia for AVD's, DMS's, and APD's	S-2804-921582
Distinguishing figures for miscellaneous ships	S-2804-921819

Table 631-10-2 LETTER AWARDS SPECIFICATIONS

Award	Insignia	Size	Location
Winner of Intra-type battle efficiency competition	White E	20″ by 16″	Bridge bulwark (fwd, port, and starboard) or sail of submarines.
Electronic warfare department	White EW	E-15″ by 10″	Port and starboard bridge bulwarks abaft the battle efficiency E. See Note 1.
Engineering	Red	Note 2	Note 2
Gunnery: 16″, 8″, 6″ turrets	White E	15″ by 12″	Center, each side of gun turret.
5″ gun mounts	White E	10″ by 8″	Center, each side of gun mount.
3″ and 40 mm mounts	White E	10″ by 8″	Center of splinter shield, outboard (on each side of centerline mounts). See Note 3.
Main battery and 5″ directors	White E	15″ by 12″	In appropriate position on each side director shield
3″ and 40 mm directors	White E	10″ by 8″	Center of splinter shield, outboard (on each side of centerline director). See Note 3.
Guided missiles	White E	15″ by 12″	In appropriate position on each side of director tower
CIC	Green E	12″ by 12″	Bridge bulwark (aft, port and starboard)
Communications	Green C	15″ by 12″	Signal bridge bulwark (port and starboard)
Assault	Assault boat insignia	15″ by 15″ or 21″ by 21″	On hull or superstructure in immediate vicinity of forward Welin davit
Minesweeping	White M	15″ by 18″	Each side of ship slightly forward of bridge
ASW	White A	15″ by 12″	In appropriate position on or adjacent to main ASW armament (port and starboard)
Safety	Green	16″ by 21″	Bridge bulwark, aft of ″Battle E″ (port and starboard)
Weapons department	Black W	15″ by 18″	Bridge bulwark (port and starboard)
Air department	Yellow E	15″ by 12″	Near area of primary flight control station

Table 631-10-2 LETTER AWARDS SPECIFICATIONS - Continued

Award	Insignia	Size	Location
Supply department	Blue E	15″ by 12″	Bridge bulwark (aft, port, and starboard)

631-10.6.3 THE NAVY E. For battle efficiency awards, it is recommended that the E be located on the bridge wing bulwark, port and starboard if practical. Otherwise, the E should be placed in the general vicinity of painted campaign ribbons.

631-10.6.3.1 Subsequent Navy E's. For the second and each consecutive award of the Navy E, one service stripe shall be painted under the E. The distance between the shading on the bottom of the E and the upper corner of the strip and between stripes shall equal half the stripe width. When facing the E, the stripe shall slant downward from the upper right to the lower left, regardless on which side it is displayed.

631-10.6.3.2 More Than 5 Navy E's. Instead of the letter and four service stripes for winning the Navy E award five consecutive times, a gold insignia shall be displayed with one silver star above the insignia. Silver stars shall be added for each five successive awards shown in Figure 631-10-1. Interim years will be indicated by gold stripes, to a maximum of four.

631-10.6.4 DAMAGE CONTROL AND DECK SEAMANSHIP DEPARTMENTAL AWARD. The Damage Control and Deck Seamanship Departmental Award is a red DC to be displayed on the port and starboard bridge wings. The Deck Seamanship insignia is shown in Figure 631-10-2 and is to be displayed on each side of the bridge bulwark abaft of the Battle Efficiency (E). The deck seamanship award for AOE, AOR, AE, AD, AR, AO and AFS ships will be 30 inches by 30 inches; all other units will be 15 inches by 15 inches.

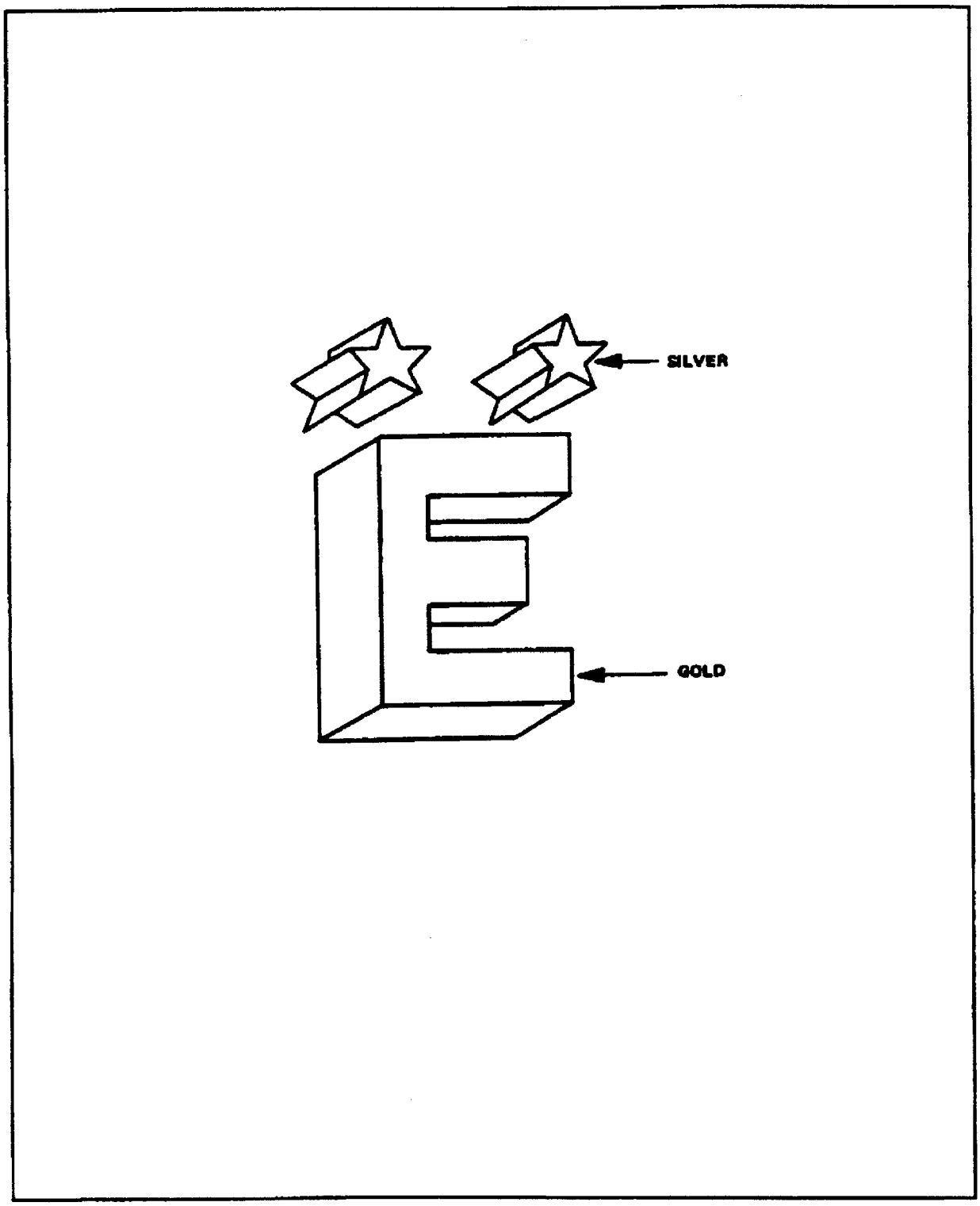

Figure 631-10-1 Example of 10th Consecutive E

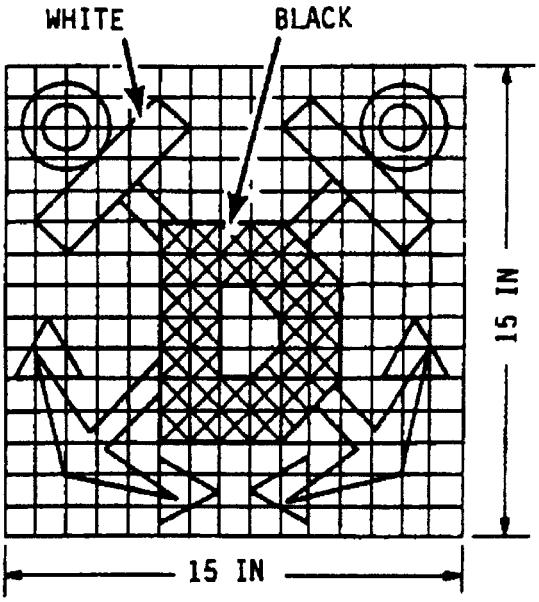

Figure 631-10-2 Deck Seamanship Insignia

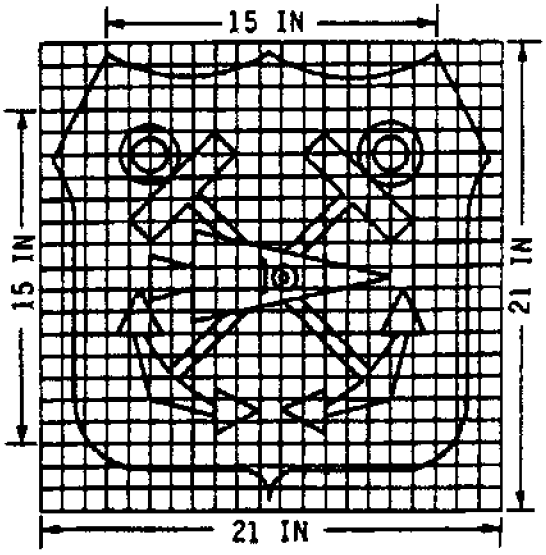

Figure 631-10-3 Example of 10th Consecutive Award Assault Boat Insignia

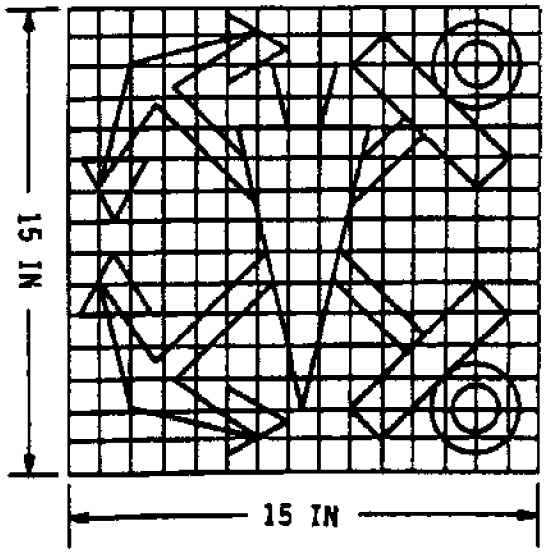

Figure 631-10-4 Assault Boat Insignia

631-10.7 SHIP AND SMALL CRAFT INSIGNIAS

631-10.7.1 SQUADRON INSIGNIA. The display of a squadron insignia on the exterior of destroyers or small-type ships is authorized at the discretion of the Fleet Commanders in Chief. It is considered that the design initiation can best be done by squadron personnel. Final approval in terms of design, size, placement on the ship exterior, and good taste, rests with the Fleet Commander in Chief.

631-10.7.2 ASSAULT BOAT INSIGNIA. The assault boat insignia shall be displayed so the arrowhead always points forward (shown in Figure 631-10-4).

631-10.7.3 CONSECUTIVE ASSAULT BOAT INSIGNIA AWARDS. For 10 or more consecutive awards, the Assault Boat Insignia shall conform to Figure 631-10-3, with the gold insignia on a blue shield background. The number of the award is designated by the appropriate blue number in the insignia. Subsequent awards are indicated by the addition of blue stripes.

631-10.7.4 REPLICAS OF CAMPAIGN AND COMMENDATION RIBBONS. Replicas of campaign and commendation ribbons to be painted on ships shall be prescribed by Fleet Commanders, who will also designate the locations and sizes. If desired, the information given in Table 631-10-3 may be used as a guide. The painted replicas of the ribbons should be arranged in the same order as ribbons worn by personnel. There should be a maximum of three ribbons for each horizontal line. The diameter of the operation and engagement stars should be 3/8 the width of the ribbon. The stars should be painted on the ribbons with the point down.

631-10.8 HOSPITAL SHIPS

631-10.8.1 RED CROSSES. The red cross shall have a width approximately equal to its height. The width of the arms shall be approximately 1/3 the width or height of the cross. Paint three red crosses (FED Spec. TT-E-489) on each side of the hull, with the center of each cross at the same distance above the ship's load waterline. Each cross shall be of the maximum possible height, but shall not exceed 9/10 of the ship freeboard at a particular location. The forward cross on each side shall be located in the vicinity of the stem so that, dependent upon the hull lines in that area, it is readily identifiable when viewed from dead ahead of the ship. The center cross on each side shall be located abaft the bridge. The after cross on each side shall be located approximately half-way between the center cross and the ship's stern.

631-10.8.1.1 Larger Sizes. Minor variations in the red cross locations are permissible if the variation permits painting a larger cross because of increased freeboard at a nearby location. If practical, paint red crosses at least 34 by 34 feet on top of the superstructure or awnings fore and aft, or on the helicopter platform in locations visible from the air. The surrounding area shall be blocked in with white paint so the red cross will stand out well on the white background. Paint four red crosses of maximum practical size on the four sides of the stack, located so the cross on the opposite side of the stack may be most clearly seen from astern. Paint one red cross of maximum practical size on the forward vertical face of the forward superstructure, where the cross may be most clearly seen from ahead.

631-10.8.2 SHIP BOATS. Boats shall be painted with a 15-inch by 15-inch red cross (on white background) on each side of the stern. Life rafts shall have 15-inch by 15-inch red crosses (on white backgrounds) on both sides.

631-10.8.3 SHIP NAME. The name of the ship shall be painted in black letters (MIL-E-24635) on each side of the bow and across the centerline of rounded sterns, or on each side of pointed sterns.

Table 631-10-3 INSIGNIA SIZES AND LOCATIONS BY REPRESENTATIVE SHIP TYPES

Ship Type	Size of Insignia	Location of Insignia
AD		
AE		
AFS		
AOR		
AR		
ARS		
AS	6″ by 18″	Windshields at wings of pilot house
ASR	4″ by 12″	
ATF		
CG		
CGN		
CLG		
CV	8″ by 24″	Bulwark area adjacent to the navigating bridge, or starboard side of hangar deck
CVA	8″ by 24″	Bulwark area adjacent to the navigating bridge, or starboard side of hangar deck
CVN	8″ by 24″	Bulwark area adjacent to the navigating bridge, or starboard side of hangar deck
DD Types	4″ by 12″	Outside of bridge shield, port and starboard, 2 feet below top edge
DDG		
FF Types	4″ by 12″	Outside of bridge shield, port and starboard, 2 feet below top edge
FFG		
LHA		
LKA		
LPA		
LPD		
LPH		
LSD	6″ by 18″	Side of wheelhouse above ports
LST		
MSO		
PHM		
SS	4″ by 12″	Side of bridge superstructure bottom edge of bottom row, 18 inches above the top of hull number or as near as the installation allows.
SSBN		
SSN		

SECTION 11.

QUALITY ASSURANCE FOR CRITICAL COATED AREAS

631-11.1 GENERAL.

The Quality Control (QC) requirements of this section shall form an integral part of a shipyard's overall QC program. The shipyard Quality Assurance (QA) organization shall be responsible for ensuring all requirements of

this section are met. At private shipyards, the local Supervisor shall monitor the contractor's performance to ensure requirements are met in accordance with applicable contracts.

631-11.2 CRITICAL COATED AREAS.

Critical coated areas are areas where premature failure of the coating system cannot be detected by routine observation due to inaccessibility (such as inside ship's tanks) and those areas where restoration of the failed system cannot be undertaken without laying up the ship at an industrial facility or a forward repair site (e.g., nuclear space, ships' underwater hull requiring dry docking, and ships' tanks requiring separation from associated systems for access, cleaning and represervation).

631-11.3 REQUIREMENTS FOR CRITICAL COATED AREAS.

Critical coated areas shall have: surface preparation accomplished by certified blasters; coatings applied by certified painters; test and inspection records maintained in accordance with Table 631-11-1; * key checkpoints signed off by certified coating inspectors; and, for commercial shipyards, final inspections performed by a certified coatings inspector authorized to represent NAVSEA.

* See additional QA requirements for potable water tanks and other high purity water tanks in applicable sections of NSTM Chapter 631.

631-11.4 TEST AND INSPECTION RECORDS.

The shipyard shall maintain auditable records of the tests and inspections listed in Table 631-11-1 for critical coated areas. The records shall be designed to provide objective quality evidence that applicable surface preparation and painting procedures were followed and that acceptable conditions and quality attributes were achieved for each parameter defined in Table 631-11-1. A separate set of records shall be maintained for each area painted. Records applicable to painting reported in docking reports shall be incorporated into the docking report. The records shall be available for three years after the delivery of the ship or completion of an overhaul or refit, unless otherwise specified. At the expiration of the records retention period, NAVSEA or its authorized representatives shall be given a written notification. If no disposition instructions are received within six months from the notification, the records may be destroyed.

631-11.5 SHIPYARD BLASTERS AND PAINTER CERTIFICATION.

The shipyard shall maintain a certification program for blasters and painters of critical coated areas. The program shall include minimum training requirements and provide for adequate records verifying the completion and currency of training for each blaster or painter involved in surface preparation of application of coatings in critical areas. Documentation shall be maintained verifying that only certified blasters and painters are used for preservation work in critical areas. Training shall include all blasting and paint application techniques and procedures appropriate to the surface preparation and coating materials being used. These techniques and procedures include mixing, conditioning and thinning of paints; proper selection, control and maintenance of blasting and application equipment; and blasting and application techniques.

631-11.6 COATING INSPECTOR CERTIFICATION.

Both shipyard and SUPSHIP Quality Assurance Departments shall maintain a certification program for paint inspectors of critical coated areas. The program shall include minimum training requirements and provide for adequate records verifying the completion and currency of training for each paint inspector involved in inspecting surface preparation, or application of coatings in critical areas. Documentation shall be maintained verifying that only certified paint inspectors are used for inspecting preservation work in critical areas. Training shall

include all techniques and procedures appropriate to inspecting the surface preparation and coating application being used. These techniques and procedures include determining the acceptability of surface preparation prior to commencement of paint application; determining the degree of compliance with blasting and painting procedures appropriate to the surface preparation and coating materials being used; and determining the acceptability of finished products in accordance with established standardized acceptance criteria. At a minimum, the coating inspector training shall be equivalent to the National Association of Corrosion Engineers (NACE), Session I, for coating inspectors. A NAVSEA approved alternate to the NACE I is the NAVSEA Coating Inspectors training course available at NSWCCD-SSES (Code 624). Contact NSWCCD-SSES for the availability of this training course. See Table 631-11-1. In addition, shipyards using high technology coatings, such as thermal spray, are required to have at least one coating inspector professionally certified, equivalent to the coating inspectors certified by NACE.

631-11.7 COATING INSPECTOR RESPONSIBILITIES.

Coating inspectors are responsible for providing reasonable confidence that material receipt and storage, surface preparation, paint application and paint curing are done in accordance with the requirements of this NSTM chapter and paint manufacturer instructions. These responsibilities require the coating inspector to: inspect material storage and receipt inspection facilities; ensure all inspection equipment requiring calibration certification is certified under organization metrology calibration programs; perform in-process inspections of blasting and painting activities in critical coated areas and verify successful completion of key checkpoints in the application process; and inspect and accept or reject final paint systems in critical coated areas.

631-11.8 INSPECTION OF STORAGE AND RECEIPT INSPECTION FACILITIES.

Inspections of the subject areas shall be done periodically to ensure paints are being stored and receipt inspected in accordance with manufacturer's product data sheets (ASTM F718) and the requirements of this NSTM chapter. It is an organizational level responsibility to obtain ASTM F718s and Material Safety Data Sheets for specified products. These documents shall reflect the properties and requirements of the specified product as of the date of Navy approval for use. Records of inspection results shall be maintained for NAVSEA audit, in a manner similar to the test and inspection records of paragraph 631-11.4.

631-11.9 IN-PROCESS INSPECTIONS.

Coating inspectors shall be given notice and shall perform an inspection of each critical coated area when the following key checkpoints are reached: surface cleaned and ready for abrasive blasting; surface abrasive blasted and ready for priming; between each successive coat of paint and between stripe coats; final coat of paint applied and area ready for final inspection. The inspector is required to examine all data maintained by the paint foreman concerning environmental conditions, surface cleanliness, surface profile and paint thickness. Certain data shall always be verified, depending on the checkpoint in question, including surface cleanliness, surface profile, dry film thickness (see Note 10 of Table 631-11-1) and workmanship. Environmental data, such as temperatures, relative humidity and dew point need only be verified if the inspector is doubtful of the recorded values. Deficiencies in personnel training, certification, record maintenance, equipment maintenance or any matter that is not in accordance with good painting practice shall be recorded. The coating inspector shall verify successful completion of each checkpoint with a signature on an appropriate form, which shall then be maintained in accordance with the instructions of paragraph 631-11.4.

631-11.10 AUDITS OF FACILITY AND IN-PROCESS INSPECTIONS.

In commercial shipyards, a certified paint inspector authorized to represent NAVSEA shall periodically audit the receipt inspection and storage facility and in-process inspections performed by shipyard paint inspectors. Any deficiencies noted shall be reported in a Quality Deficiency Report (QDR).

631-11.11 INSPECTION OF FINAL COATING SYSTEM.

Inspection of final coating systems shall be performed in accordance with section IV.1.e of Table 631-11-1 by certified paint inspectors authorized to represent NAVSEA. Coating imperfections found, which may cause premature coating failure, shall be corrected before the paint system is accepted using appropriate touch-up procedures. Slight imperfections in the coating system are allowable, as long as they will not result in premature failure of the coating in the immediate vicinity of the imperfection. Such slight imperfections should be left intact, as trying to correct them could result in damage to the surrounding coating system. Failure to meet minimum dry film thickness requirements shall result in application of an additional coat or coats of paint in deficient areas before the coating system is accepted.

631-11.12 REVIEW OF RECORDS FOR FINAL COATING EVALUATION.

A certified paint inspector authorized to represent NAVSEA shall review the paint records of each critical area to ensure the shipyard has maintained adequate control of the painting process. Records shall include all the test and inspection data required by Table 631-11-1. Failure to produce such records, or records which indicate that blasting and painting was not done in accordance with governing specifications/instructions, may be grounds for rejection.

631-11.13 ACCEPTANCE/REJECTION OF FINAL COATING SYSTEMS.

Certified coating inspectors authorized to represent NAVSEA are responsible for accepting or rejecting completed coating systems in critical coated areas. Acceptance or rejection of coatings shall be based on a review of the painting records for the area and in inspection of the area, in accordance with paragraphs 631-11.11 and 631-11.12.

Table 631-11-1 QUALITY CONTROL PARAMETERS FOR SURFACE PREPARATION AND PAINTING OPERATIONS IN CRITICAL COATED AREAS

Parameter	Shipyard Procedure Coverage[1]	Test or Inspection Record Coverage
I. Materials		
1. Sources of receipt inspection	1.a. Requirement to assure material certification for blast media is in accordance with MIL-A-22262.	1.a. Copy of material certification.
	1.b. Procedures for conformance tests to be conducted, as required, to provide reasonable confidence that the paint meets specification requirements.	1.b. Document the following for receipt inspection of paints for tanks as follows:[2] A. Date paint was received B. Purchase order number C. Receiving location D. Paint manufacturer E. Product name and number F. Batch number of paint G. Shelf life of paint (expiration date) H. Quantity received (gals) I. Results of conformance tests[9] J. Remarks K. Signature of Supervisor or Q.A. Inspector

Table 631-11-1 QUALITY CONTROL PARAMETERS FOR SURFACE PREPARATION AND PAINTING OPERATIONS IN CRITICAL COATED AREAS - Continued

Parameter	Shipyard Procedure Coverage[1]	Test or Inspection Record Coverage
2. Storage	2.a. Requirement to check shelf life of paints for critical coated areas prior to issue from warehouse.	2.a. Certification of adequate shelf life at time of issue from warehouse.
	2.b. Requirement to discard paints whose shelf life has expired, or will expire prior to use, or reverify quality (by testing) of paints that exceeded their shelf life.	2.b. Record results of requalification testing.
II. Surface Preparation[3]		
1. Abrasive Blasting	1.a. Requirements for dew point, relative humidity, ambient temperature and surface temperature in accordance with **NSTM Chapter 631** .	1.a. Record the dew point, relative humidity, ambient temperature and surface temperatures prior to and every 4 hours during abrasive blasting.
	1.b. Requirements for cleaning surfaces free of oil, grease, and other contaminants which could become imbedded in the surface by blasting.	1.b. Results of pre-blast inspection.[8]
	1.c. Degree of blast cleaning relative to surface being prepared and paint to be applied after blasting.[5]	1.c. None
	1.d. Blasting methods and abrasive size, to ensure acceptable surface preparation and profile.[4]	1.d. None
	1.e. Requirements for postblasting cleanup prior to commencement of painting.	1.e. None
	1.f. Requirement for postblasting and prepainting inspection.	1.f. Results of inspection, including condition of prepared surface and profile, adequacy of cleanup and readiness to commence painting.[2, 6, 11]
2. Other Cleaning Methods	2.a. Procedures for miscellaneous cleaning methods (e.g., solvent, fresh water, steam, citric acid, power tool, etc.).	2.a. In accordance with appropriate process instructions.
	2.b. Surface conditions to be achieved.	2.b. Results of prepaint inspection for surface preparation and cleanliness.[2]
III. Painting		
1. Environmental	1. Requirements for dew point, relative humidity, ambient temperature and surface temperature in accordance with standards of **NSTM, Chapter 631** , or paint manufacturer's instructions.	1. Record the dew point relative humidity, ambient temperature and surface temperature prior to and every 4 hours during paint application.[8]

Table 631-11-1 QUALITY CONTROL PARAMETERS FOR SURFACE PREPARATION AND PAINTING OPERATIONS IN CRITICAL COATED AREAS - Continued

Parameter	Shipyard Procedure Coverage[1]	Test or Inspection Record Coverage
2. Materials	2.a. Paints in accordance with ship's schedule as modified by **NSTM Chapter 631** , standard work item 009-32, instructions for nuclear spaces, or ship non-deviation drawings.	2.a. None
	2.b. Procedures for controlling the use of paint during inclement weather and where industrial operations occur (e.g., blasting, grinding, sweeping) to ensure protection from airborne contaminants.	2.b. None
3. Mixing	3.a. Mixing ratios, techniques, and thinners applicable to paint (**NSTM, Chapter 631** , or paint manufacturer's instructions).	3.a. Random verification of compliance.
	3.b. Requirements for conditioning temperatures. Induction times in accordance with **NSTM, Chapter 631** , or paint manufacturer's instructions.	2.b. None
4. Application	4.a. Requirement to record time blasting and priming in accordance with **NSTM, Chapter 631** .	4.a. Time between blasting and priming.
	4.b. Procedure for ventilation requirements for the type of tank being painted.	4.b. For potable water and feedwater tanks, verification of compliance to requirements of **NSTM, Chapter 631** .
	4.c. Inspection and measurement criteria such as wet film thickness.	4.c. None
IV. Cure/Post Cure		
1. Drying	1.a. Requirement for inspection of each coat of paint for workmanship and dry film thickness applied in accordance with **NSTM, Chapter 631** .	1.a. Inspection Results.[2, 7]
	1.b. Requirements to record time between subsequent coats of paint in accordance with **NSTM, Chapter 631** .	1.b. Time between subsequent coats of paint.
	1.c. Requirement to precoat (stripe) all flanges, edges and weld seams with next coating to be applied between each coat of specified system in accordance with **NSTM, Chapter 631** .	1.c. Verification striping was done.[2]

Table 631-11-1 QUALITY CONTROL PARAMETERS FOR SURFACE PREPARATION AND PAINTING OPERATIONS IN CRITICAL COATED AREAS - Continued

Parameter	Shipyard Procedure Coverage[1]	Test or Inspection Record Coverage
	1.d. Required time for drying and curing prior to service; requirements for environmental conditions.	1.d. Drying and curing times.[8]
	1.e. Requirements for inspection of finished painted surfaces for workmanship (e.g., drips, runs, sags) and total film thickness applied.	1.e. Inspection results.[2, 7]
	2. Requirements for touch-up.	2. Inspection of proper paint used and final thickness.[2]

REAR SECTION

NOTE

TECHNICAL MANUAL DEFICIENCY/EVALUATION EVALUATION REPORT (TMDER) Forms can be found at the bottom of the CD list of books. Click on the TMDER form to display the form.